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Sudbury, Cobalt and Porcupine Geology

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In northern Ontario, near the southern edge of what is known as the protaxis, or great shield-shaped region, that is underlain essentially by rocks of pre-Cambrian age, and occupies over one-half the surface of Canada, are the three well known mining areas of Sudbury, Cobalt and Porcupine, shown in the map. Numerous descriptions of these mining areas have been published, but a brief account of their geological relations may be of interest.

Fig. 1. White, Native Silver; Gray, Smaltite; Black Spots, Niccolite; Large Black Patches, Calcite

Fig. 2. Boulder of Conglomerate of Timiskaming Series in Conglomerate of Cobalt Series

Geological Research Instigated by Mineral Discovery

Without doubt had it not been for the great economic importance of the iron and copper region bordering Lake Superior on the United States side of the boundary, comparatively little would yet be known of its geology. But being the possessor of the greatest of the world's iron resources yet developed, and of great mines of native copper has caused both the Dominion and United States governments to make expenditures on geological work in the region that would otherwise never have been made. Extensive underground work has assisted greatly in the interpretation of the geological structure of the region. The results achieved by the Lake Superior geologists are monumental.

While the groundwork in connection with the interpretation of pre-Cambrian geology was accomplished on the Canadian shore of Lake Huron 50 or 60 years ago, but little progress was made, compared with that on the United States side of the boundary, for a long period afterward, owing to less encouragement by the mining industry. The development of Sudbury, Cobalt and Porcupine has, however, brought about a change in conditions. More money has been supplied for field work, and the knowledge obtained of the pre-Cambrian areas in the United States has been available. The result is that within the last few years a fairly good working knowledge of the geology has been obtained of the region in which Ontario's three great mining areas are situated.

Sudbury Greatest Nickel Producer

It is well known that Sudbury is the world's greatest producer of nickel and an important producer of copper. Moreover the production is growing rapidly and the ore-bodies of the region appear to be inexhaustible. It is safe to say that at the present time millions of tons more of ore have been proved to exist than were known even five years ago, although mining has been carried on for over 25 years.

As nearly as can be determined from government reports, Sudbury had produced in round numbers 158,000

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tons of nickel and 103,000 tons of copper by the end of 1912. Statistics of byproducts—platinum, palladium and gold—are incomplete.

Cobalt and Porcupine Important Producers

Like Sudbury, Cobalt has the distinction of being one of the prominent mining areas of the world. In 1911 and 1912, for instance, it supplied over 13% of the world's production of silver. Moreover, it controls the market for cobalt and its compounds, producing in fact a large surplus over consumption. It is also a large producer of arsenic. While, next to Sudbury and New Caledonia, Cobalt has been the world's largest producer of nickel, this metal is not considered of much economic value in the Cobalt area, owing to its associated metals and the methods used for refining them. To the end of 1912, Cobalt has produced approximately 156,000,000 oz. of silver, the production in 1912 being 30,260,635 oz. The total distribution of profits since the beginning of mining in the area has been nearly 41 million of dollars on a gross aggregate return for sale of silver of $81,777,-260.

Although a number of properties at Porcupine have been largely developed, it is within only the last few months that the two larger milling plants have been in operation. The production during the next year will give Ontario recognition as a gold-producing country. In 1912, the gold output of the province had a value of $1,-859,285, as compared with $42,637 in 1911.

Sudbury and Cobalt Ores from Molten Magmas

The ore deposits of all three of these areas are in rocks that are classified as of pre-Cambrian age. While the deposits differ greatly, both as regards form and mineral content, it is believed that all of them owe their origin to igneous intrusions. At Sudbury, the intrusive rock is quartz-norite, at Cobalt quartz-diabase, and at Porcupine granite.

In the opinion of most observers who have studied them, the Sudbury ores, essentially a mixture of pyrrhotite and copper pyrites, are direct segregation deposits from the norite magma, but there may also have been some later deposition of ore minerals.

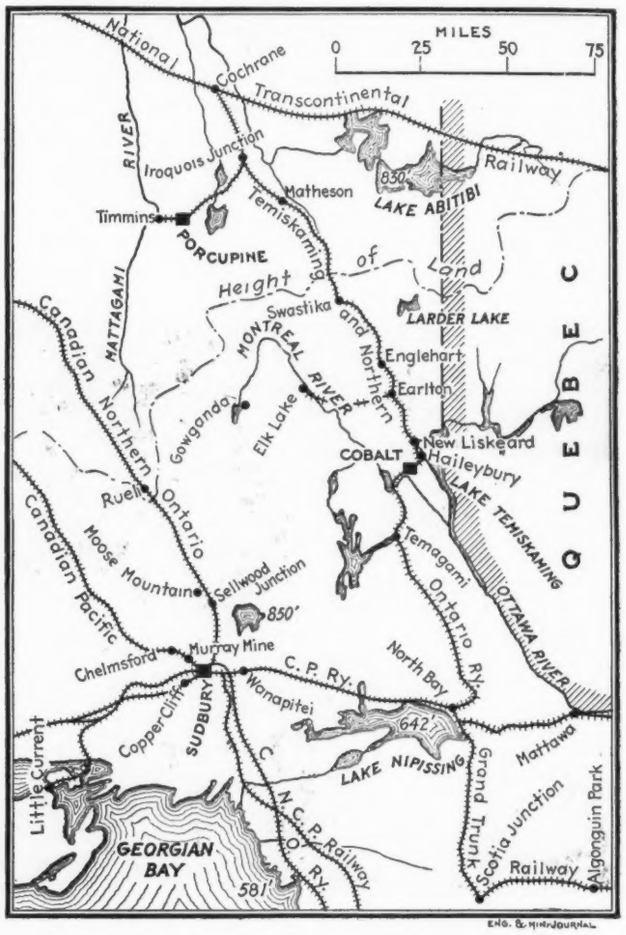
The Cobalt ores, essentially arsenides of cobalt and nickel with native silver, are, like those of Sudbury, believed to be directly connected with intrusions of igneous rocks. Not only at Cobalt but in the surrounding region, about 5000 square miles in extent, the ores are associated with quartz-diabase in such a way as to lead to the belief that they were deposited from heated, impure waters that followed the diabase intrusion. Thus both the Sudbury and Cobalt ores may be considered as coming from molten magmas, the former by direct segregation with the intervention of little water, while those of Cobalt may be looked on as the end product of the diabase intrusion, deposition taking place from aqueous solution.

While granite is not exposed at most of the Porcupine mines, it surrounds the gold area. The rocks in which the veins occur form what may be called a large, island-like area upon the granite, which probably underlies most of the area. The presence of feldspar, tourmaline and scheelite in the quartz of the gold veins suggests a close connection between the veins and granite intrusions.

It is of interest to note that, at least, most of the silver at Cobalt and most of the gold at Porcupine was deposited in the veins after the latter had been fractured and disturbed. At Cobalt the vein filling, before the disturbance took place, consisted essentially of cobalt-nickel minerals and dolomite, and at Porcupine of quartz. Figs. 1 and 3, show characteristic specimens from the two camps.

Keewatin Rocks Oldest in the Region

Although the triangle-shaped region that includes the three areas is 8000 square miles in extent, there is a close resemblance of the rocks of one area to those of the



Sudbury, Cobalt and Porcupine Districts of Ontario

others. Broadly speaking, there are five or six great groups of pre-Cambrian rocks in the region. Insofar as it is possible to correlate them, each of these groups, with the possible exception of the Animikie, of Sudbury, is present in each of the mining areas, although some groups are more prominent in one area than in the others and *vice versa*.

The oldest group of rocks in the region is the Keewatin, which consists typically of greenstones, green schists and other types that are essentially of volcanic origin. Excellent exposures of the Keewatin are to be seen at the mines in Cobalt and Porcupine, but the series does not appear to be present at the Sudbury mines, although it is exposed at no great distance from them.

Certain sediments, such as the iron formation or jaspilite, which is so characteristically associated with the

Keewatin, are usually grouped with this series. The present authors, however, are inclined to place the jaspilite and other sediments associated with it, such as graywacké and crystalline limestone, with the Grenville series that is so characteristic of southeastern Ontario and adjacent areas of Quebec province and New York state.

While jaspilite is widespread in northern Ontario, and in the pre-Cambrian areas of the Lake Superior country generally, and in places has a considerable thickness, the crystalline limestone associated with it is not so prominent as it is in southeastern Ontario, where it and associated sediments have a great thickness, owing in all probability to their having been subjected to less erosion.

Grenville Series in pre-Cambrian Classification

The Grenville series should be given, in a classification of the pre-Cambrian, a place such as that accorded to Keewatin, Laurentian, Huronian or Keweenawan. If this is done, the dual grouping of the pre-Cambrian followed by most writers should be discarded. The thickness of the sediments in the Grenville and the character of the deposits make it inadvisable to attempt to subdivide the pre-Cambrian into an upper characteristically sedimentary group and a lower igneous complex. Part of the igneous rocks classed as of Keewatin age may be practically contemporaneous with part of the Grenville sediments. Certain sediments in the Grenville of southeastern Ontario, and associated with the jaspilite of northeastern Ontario, have a strong resemblance to the Couchiching of the far northwestern part of the province.

Table I shows the age relations of the groups of rocks, with the exception of certain minor intrusives, in the Cobalt-Porcupine region:

TABLE I. AGE RELATION OF ROCK GROUPS

Dikes of aplite, diabase, etc.	Intrusive contact
Nipissing diabase	Intrusive contact
Cobalt series	Erosion contact
Lorrain granite	Intrusive contact
Timiskaming series	Erosion contact
Laurentian granite and gneiss	Intrusive contact
Grenville series	
Keewatin.	

Sedimentary Rocks of Porcupine and Cobalt Similar

The Laurentian, consisting of granite and gneiss, intrudes both the Keewatin and the Grenville. The rocks occupy large areas in the Canadian protaxis. Typically the color is gray, but varies, owing to inclusions and absorption of rocks through which they have intruded. Frequently they have a banded appearance, light and dark bands alternating. The dark bands appear to be essentially inclusions of Keewatin rocks that have been squeezed or drawn out. Pebbles and boulders of the Laurentian granite and gneiss are found in the Timiskaming series.

Owing to the difficulty of determining the ages of granites, where they are not in contact with rocks whose position in the time scales is known, acid intrusions of various ages have been classed as Laurentian, a term which properly should be applied to granites and granite gneisses of pre-Timiskaming age. Since certain granites, later in age than the Laurentian, are believed to be genetically connected with deposits of gold and other minerals, it bocomes of economic importance to determine their age relations. If all the granites and gneisses of post-Timiskaming age were separated from the Laurentian, the volume of the latter would be considerably less than it has been represented to be.

It is difficult to correlate the groups of sediments of one locality with those of another. At Cobalt and Porcupine, however, although the areas are about 100 miles apart, the striking resemblance of sediments in one area to those of the other, together with their relations to intrusives, appears to warrant the correlation of the two groups of post-Laurentian sediments of the one area with those of the other.

To the older group or series of sediments in the vicinity of Cobalt the name Timiskaming has been applied.[1] These sediments, consisting essentially of conglomerate, graywacké and quartzite, have on the whole a different appearance from the younger Cobalt series. They dip at higher angles than the latter and have a lighter color. But at times there is a strong resemblance between the two series. The difference in age between them is, however, brought out by the fact that the Lorrain granite and certain lamprophyre dikes intrude the Timiskaming series but are separated from the Cobalt series by an unconformity indicated by erosion. Moreover, boulders of conglomerate of the Timiskaming series are found in the conglomerate of the Cobalt series, as shown in Fig. 2. The Cobalt series, considering that 80% or more of the silver production has come from veins in these rocks, is the most important one at Cobalt. The Lorrain granite, which intrudes the Timiskaming series, but has been eroded, furnishing numerous boulders to the Cobalt conglomerates, is believed to be represented at Porcupine by granite, the intrusion of which into the Keewatin and Timiskaming series of that area gave rise to the gold-bearing quartz veins. The Keweenawan is believed to be represented at Cobalt by the Nipissing quartz-diabase that intrudes the Cobalt series and rocks of earlier age. Basic dikes at Porcupine appear to be of the same age.

TABLE II. CHEMICAL COMPOSITION OF THE ROCKS

	Nipissing Diabase at Cobalt		Sudbury Norite	
	I	II	III	IV
SiO_2	50.12	48.06	49.90	51.52
Al_2O_3	15.70	18.23	16.32	19.77
Fe_2O_3	1.42	9.57	.....	0.47
FeO	6.89	.....	13.54	6.77
MgO	9.50	7.80	6.22	6.49
CaO	11.30	11.55	6.58	8.16
Na_2O	2.91	1.87	1.82	2.66
K_2O	1.07	0.27	2.25	0.70
$H_2O + CO_2$	1.03			
H_2O		3.54	0.76	1.68
MnO	.....	.....	trace	trace
TiO_2	0.55		1.47	1.39
P_2O_5	.....	.....	0.17	0.10
S	0.14	.....	.....	.....
	100.84	100.89	99.03	99.71

I. Diabase, O'Brien mine, Cobalt, N. L. Bowen, analyst.
II. Violet mine, Cobalt, J. O. Handy, analyst.
III. Basic edge of the southern range near Blezard mine, Sudbury, T. L. Walker, analyst.
IV. Basic edge of the southern range near Blezard mine, Sudbury, T. L. Walker, analyst.

Temiskaming and Cobalt Series at Sudbury

While groups of rocks at Sudbury appear to have age relationships that should warrant their being correlated with groups at Cobalt and Porcupine, it should be understood that at present a correlation is to be considered as only provisional. As already said, the Keewatin is present in the vicinity of Sudbury, and probably certain sediments in that area should be classed with the Timiskaming series. The sediments, lying in the basin that is practically surrounded by the norite at Sudbury, have been classed as of Animikie age. There are no rocks

[1] "Eng. and Min. Journ.," Sept. 30, 1911.

at Cobalt that can be classed with these, if we except the Cobalt series itself. If, however, the Ramsey Lake conglomerate is older than the Trout Lake conglomerate and other members classed as Animikie, at Sudbury, then it would seem that in the region there are two groups of almost flat-lying sedimentary series, the Cobalt-Ramsay Lake series and the Animikie.

In the first paper he wrote on the Cobalt area the senior author was inclined to classify the rocks now known as the Cobalt series with the Animikie, owing simply to the fact that they are flat-lying and little disturbed.[2]

It would appear that the Timiskaming is present at Sudbury, since a series of fragmental rocks, including conglomerate, intruded by granite and classed as Lower

TABLE III. ANALYSES OF THE ACID OR GRANOPHYRIC FACIES OF THE ERUPTIVES

	I	II	III	IV.	V
SiO_2	72.33	62.54	61.93	67.76	76.03
Al_2O_3	12.99	14.79	13.03	14.00	13.02
Fe_2O_3	0.00	0.00	0.56	0.00	1.44
FeO	2.50	8.49	8.00	5.18	1.29
MgO	0.97	2.08	1.76	1.00	0.16
CaO	1.73	1.49	4.02	4.28	0.15
Na_2O	7.60	6.27	3.18	5.22	3.68
K_2O	0.00	1.12	2.80	1.19	3.74
H_2O	1.09	3.51	1.95	1.01	0.96
TiO_2	0.74	0.00	0.84	0.46	0.00
P_2O_5	0.00	0.00	0.32	0.19	0.00
MnO	0.00	0.00	0.18	trace	0.00
CO_2	1.00				
S	0.00	0.00	0.19	0.00	0.00
	100.95	100.29	98.76	100.29	100.47

I. University mine dike, Cobalt, N. L. Bowen, analyst (Journal Can. Min. Inst., Vol. XII.)
II. Lost Lake granophyre, Gowganda, Cobalt-Silver area, N. L. Bowen, analyst.
III. Acid edge of nickel eruptive, Onaping section, Sudbury, E. G. R. Ardagh, analyst.
IV. Near acid edge of the Blezard-Whitson lake section, Sudbury, T. L. Walker, analyst.
V. Lorrain granite dikes, fine in grain or aplitic, Cobalt. About a dozen specimens were taken to get an average.
Analysis No. V is added to the table to show the difference in composition between the dikes of Lorrain granite and the acid facies of the Nipissing diabase and Sudbury norite. In all the analyses of the latter the proportion of soda to potash is high while in the case of the Lorrain granite dikes it is more nearly equal.

Huronian, is known to occur there.[3] This so called Lower Huronian appears to contain Grenville sediments, as well as those of Timiskaming age. In the classic Huronian area, on the north shore of Lake Huron, there are at least two series of fragmental rocks separated by an unconformity of considerable magnitude, and with, at times, a striking discordance in dip.[4] It is, therefore, possible that both the Timiskaming and Cobalt series are represented in that area.

Certain fine-grained sediments, including crystalline limestone, in the Sudbury-Wahnapitae-Moose Mountain area, appear to represent the Grenville series. More or less schistose sediments in the classic Huronian area may belong to the same series.

Sudbury Norite and Cobalt Diabase

In the first and later editions of his report on the Cobalt area, the senior author drew attention to certain resemblances between the quartz-diabase, or Nipissing diabase, which is considered to have given rise to the Cobalt silver ores, and the norite of Sudbury which most authors believe is responsible for the great nickel deposits. The norite and diabase, while being basic rocks, are characterized by the presence of free silica, or quartz, as an essential constituent. At Cobalt and in the surrounding region the quartz-diabase occurs in sills. In the immediate vicinity of Cobalt itself the diabase occupies fully one-half the surface of the productive area, the upper wall of the sill having been removed. In the surrounding region, 5000 square miles in extent, the diabase shows frequent outcrops.

The following notes bring out the resemblances in chemical and mineralogical character of the diabase and norite. Unfortunately at Cobalt there is no means of determining the exact age of the diabase. All that can be said is that it is of more recent age than any of the pre-Cambrian sediments. At Sudbury the norite intrudes rocks which are believed to be of Animikie or Upper Huronian age. It is not at all unlikely that the diabase and norite of Cobalt and Sudbury respectively are of the same age as the Keweenawan basic igneous rocks of Michigan and of the Lake Superior country generally.

Resemblance of Diabase and Norite

The thickness of the Nipissing diabase sill at Cobalt is five or six hundred feet or more, while the norite at Sudbury is believed by A. P. Coleman[5] to have an aver-

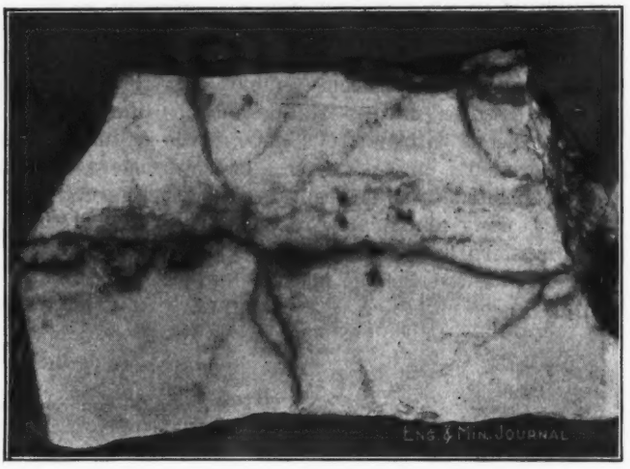


Fig. 3. Polished Quartz from Porcupine, Showing Dark Streaks in Crushed Area. Iron Pyrites Abundant Along Dark Lines, with Visible Gold

age thickness of a mile and a quarter. These eruptives both show differentiation, or insensible gradations, from such basic rocks as diabase, gabbro and norite to acid rocks with the composition of granite. The differentiation appears to have taken place on a larger scale at Sudbury than at Cobalt and the surrounding region. Although the basic portion (norite) of the nickel eruptive is coarser in grain than the Nipissing diabase, it nevertheless resembles petrographically the latter rock. For instance, in the descriptions by A. P. Coleman[6] and A. E. Barlow[7], it is brought out that the nickel eruptive sometimes shows "distinct traces and, at times, well marked diabasic or ophitic texture." Furthermore, the basic facies of each contain quartz, usually intergrown in micrographic fashion with an acid plagioclase. When this micrographic intergrowth increases in quantity until it finally becomes the predominant constituent, a rock with the chemical composition of granite results, which is

[2] Thirteenth report, Ontario Bureau of Mines, p. 102.
[3] Bulletin 360, U. S. Geological Survey.
[4] Idem.
[5] Fourteenth report, Ontario Bureau of Mines, Part III, p. 11.
[6] Idem.
[7] Annual report, Geological Survey of Canada, Vol. 14.

commonly called micro-pegmatite, granophyre or aplite. At Cobalt and in the surrounding region, while the aplite is considered to have come from the same magma as the diabase, it occurs characteristically as dikes in the latter. In other words, at Cobalt there was eruption of diabase, followed by intrusion of aplite dikes representing a part of the residual magma, and then the cobalt-silver ores were deposited by the waters that followed the intrusions.

Alaska Gold Mines Co.

The first report of the Alaska Gold Mines Co. has been presented, covering the period since the organization of the company, in August, up to the end of 1912.

Mines Near Juneau, Alaska

The principal holding of the company is the property of the Alaska Gastineau Mining Co., situated in the vicinity of Juneau, Alaska, in what is known as the Juneau gold belt. The mining property is on the main land about three miles from the Gastineau Channel, an inland passage of the Pacific Ocean, through which Juneau and the vicinity are reached by the largest vessels of the Alaska trade. The mining claims owned by the company consist principally of four groups, locally known as the Alaska Perseverance, the Ground Hog, the Silver Bow Basin and the Sheep Creek. In addition to these the company has acquired smaller groups and individual claims, sufficient to make a total holding of about 1200 acres, having a maximum length of about 18,000 ft., and a maximum width of about 5000 ft., covering the Gold Creek lode-system contact and series of veins for a length of over two miles.

Besides its mining property, the company owns valuable water rights and rights-of-way for flumes, pipe lines and power plants on Gold and Granite Creeks, in the vicinity of the western end of its mining area. It also owns exclusively water rights, a reservoir site and rights-of-way for flumes, pipe lines, tramway and power plants on Salmon Creek, which is a stream entering into the Gastineau Channel, about three miles westerly from Juneau. Three miles east of Juneau, on the beach of Gastineau Channel, the company owns a large tract of land intended as a site for a large reduction plant. It also owns a narrow-gage railroad between this mill site and the portal of the Sheep Creek tunnel, which is being driven to develop the orebodies at depth and to serve as the main outlet for the mine. In the locality of the mill site, the company owns water rights and rights-of-way for flume and pipe lines sufficient for its requirements.

Prior to the organization of the Alaska Gold Mines Co., these mines and properties were examined by mining engineers, who reported the existence of a large tonnage of gold ore, averaging about $2 per ton, according to sampling and assaying done in the usual way. All of the principal groups previously named as constituting the major portion of the mining property have been developed and worked to some extent, but the greatest amount of work has been done on the Perseverance group. Small milling plants had been operated in connection with the Perseverance, Sheep Creek and Ground Hog group, and in 1907 a 100-stamp mill, having a capacity of about 500 tons per day, was constructed and put in operation on the Perseverance section.

This mill could only be operated for a few months in the summer on account of shortage of water for power and milling purposes during cold weather, but up to the end of the year 1911, it had treated over 300,000 tons of ore from the Perseverance vein. The maximum recovery for any year of the five-year period was $2.26 per ton, and the minimum for the same period was $1.45 per ton, the average for the five years being in excess of $1.75 per ton. The average gross value of the 300,000 tons of ore delivered to the mill during the five years was about $2.05 per ton, which value checked closely with the examining engineers' sampling of the workings from which this ore was extracted. At the time of this examination, the Perseverance vein had been developed to an average width of 70 ft., and a length of about 1800 ft., these developments being at a depth of 1600 ft. on the dip of the vein. For a portion of this length, the vein had been partially stoped and otherwise developed to a maximum height of over 200 ft. above the main level. The evidence of this work, together with that of surface development along the outcrop of the vein, was considered by the examining engineers as sufficient upon which to base a technical estimate of about 17,000,000 tons of ore as reasonably to be expected above the main level and within the length of the vein developed at the time the examination was made in the autumn of the year 1911.

Ore Reserves Materially Increased

In July, 1912, other engineers made another examination of the property, who, after taking into consideration the character of the deposit, and the evidence produced by surface development, considered it certain that the orebody would extend for not less than 4500 ft. along the vein, and after making reasonable allowances for extensions and depths they estimated the quantity of ore definitely indicated as not less than 50,000,000 tons. On the basis of these reports and estimates, taken together with the records of operation and production of the various groups, the decision was reached to refinance the property in such a way as to provide means for the construction of a mill of 6000 tons daily capacity, and the development and equipment of the property, as rapidly as possible, for mining and milling at that rate.

In view of the unsatisfactory location of the mill in use, it was decided to erect the new plant near the Gastineau Channel, where a plentiful supply of water is available.

It was also decided to develop the Salmon Creek water rights for a production of 6000 hp., and to provide a suitable reservoir to insure this amount of power constantly in all seasons. The selection of the coast site for the new mill made it necessary to drive a 10,000-ft. working and transportation tunnel to develop the Perseverance vein about 700 ft. deeper than the present Alexander or main level, and as this tunnel was driven parallel to the vein and in part, at least, in it, the result will be the development of the vein on this level for a length of 11,000 ft. The tunnel will be connected with the mill by a narrow-gage railroad, two miles in length, which was constructed some years ago for a part of the distance and used in the transportation of ores from the Sheep Creek mines to a small mill, situated near the coast. At some later time, it is planned to drive a still deeper tunnel about 9000 ft. long from a point on the beach of the

channel. This tunnel is expected to develop a vein about 1400 ft. deeper than the present Alexander level, and will serve as an added transportation-way to the mill for ores from deeper workings for increased tonnage.

During 1912 the Alexander level reached a total length of about 2500 ft., with crosscuts at intervals of about 200 ft. All the extensions for the last year have been to the east, and orebodies of normal size, character and grade have been disclosed, although the grade of ore found in the more recent extensions is rather higher than normal, as was expected from the favorable surface indications.

The working shaft already existing from the Alexander level to the surface is being enlarged and it is also being sunk to the level of the Sheep Creek tunnel, about 700 ft. below. This shaft will serve to deliver employees and supplies to the levels both above and below the Alexander level. The main level is still being extended in both directions and raises are being driven at suitable intervals to the surface. These will ultimately be extended to the Sheep Creek tunnel level to serve as ore chutes. Intermediate levels are being driven at intervals of 200 ft. between the main level and surface, these serving as levels from which stoping operations will be conducted and will connect with the working raises previously mentioned. Sheep Creek tunnel, which will serve as a main outlet of the mine for the delivery of ore to the mill at tidewater, was started late in 1912, and is advancing at the rate of about 500 ft. per month, which will complete it to the point of connection with the Perseverance shaft and workings early in 1914. Power and compressor plants necessary for development have been provided at both the Sheep Creek and Perseverance sections. The main compressor plant for permanent working purposes will be located at the mouth of the Alexander tunnel, on the Perseverance section, and plans for this plant have been completed and machinery already ordered.

During 1912 over 100,000 tons of ore were broken in the Perseverance vein and 75,000 tons were milled. The total ore mined, milled and sampled from the Perseverance vein since it was opened on the present level has been about 750,000 tons. Of this amount 350,000 tons have been milled, the remainder having been left in the stopes to support the walls of the vein. Toward the end of 1912, the 100-stamp mill, which had just been closed down for winter, was destroyed by fire. Its operation during the summer and autumn months resulted not only in a profit but gave, from excellent experimental work, a large amount of data useful in the determination of the designs and methods best suited for the new plant. The necessary experimental work was not altogether completed, and, to finish it, the old Sheep Creek mill, near the new millsite, was in part remodeled and used experimentally.

Larger-Scale Operation Planned

Designs for a 6000-ton concentrator are underway. The site for this plant has been cleared and active construction work will be begun during the summer of 1913. The narrow-gage railroad connecting the plant site with the entrance of the Sheep Creek tunnel, a distance of about two miles, is being relocated, and during the year 1913 will be reconstructed and relaid with heavier steel. This road will be operated electrically, the same equipment being used for underground haulage in the Sheep Creek tunnel.

Power will be from a development of the Salmon Creek water power and contemplates two stations of equal capacity, whereby the total head will be used in two approximately equal stages of about 500 ft. each. The lower station has been completed and is now delivering power to all points of development and construction. It is expected that the upper station can be completed during 1913.

All development and construction-work plans have advanced at a rate that give every assurance of the beginning of active mining and milling operations before Dec. 31, 1914, and, barring delays which cannot now be foreseen, a portion of the new mill should be in operation prior to that date. All estimates of tonnage which have been referred to in this statement have been made in consideration of the Perseverance vein only. This vein has an average width, so far as proven, of about 70 ft., and has been developed to a greater or less extent for a length of about three miles on the Alaska Gastineau and adjoining properties. Until lately the deepest workings from this vein were those at the level of the Alexander tunnel, about 1600 ft. from the surface. Recent developments on neighboring claims have cut this vein at a depth of about 1000 ft. below the Alexander level, and the assays there are said to be as high as in the tunnel.

Developments of the past few months in the Perseverance section have confirmed the existence of another vein which is much larger than the Perseverance, and, in a general way, parallel to it. A mill run of several hundred tons from this vein demonstrated an average value of $1.50 per ton. This development, taken in connection with the satisfactory extensions of ore-bearing zones in the Perseverance vein, affords assurances that the tonnage of the property as ultimately developed and worked will be much greater than the highest estimate on which the capacity of the facilities and equipment now being installed were based. It is probable, therefore, that by the time the mill now being constructed is finished, the development of ore reserves will warrant a much larger capacity than 6000 tons per day.

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Le Roi No. 2, Limited

The report of the Le Roi No. 2, Ltd., for the year ended Sept. 30, 1912, shows that its operations in Rossland, B. C., resulted in the production of 40,112 tons of ore, of which 18,257 tons were shipped to the smeltery, the average value per ton being $20.10, and 1658 tons of concentrates were produced averaging $25.75 per ton from 17,116 tons of low-grade ore. Mining costs were $3.46 per ton and smelting charges $5.77, making a total after allowing for development and depreciation of $12.18 per ton, as against $11.41 for the previous year.

The systematic working of the mine was much hampered during the period under review by the serious question which arose between the company and the Consolidated Mining & Smelting Co. of Canada, as to the ownership of certain orebodies found and worked by the Le Roi company, and which were claimed by the Consolidated company under the extralateral-right law, which was in force when the claim was originally staked. This matter has now been settled satisfactorily to all concerned. Under this arrangement, the boundaries between the two properties were adjusted, extralateral rights abolished and all claims for damage or trespass waived.

The way is now clear for a comprehensive scheme of development in the large area to the north of the Josie, one of the immediate objects of which will be to search for the continuation of the oreshoots known to exist in the War Eagle mine, which is one of the richest and most extensive in the camp. Development work to the extent of 5845 ft. was done at a cost of $14.38 per ft., and 14,185 ft. of diamond drilling at a cost of $1.69 per ft. The most important result of this was the discovery of ore at a depth of 1500 ft. The grade is not high, but a large tonnage was shipped and the results are considered satisfactory as showing that at depth good mineralized ground exists. Good-grade bodies of ore were encountered on the 700-ft. level of the Poorman vein and on the Annie vein, above the 600-ft. level.

In the concentrating plant 17,115 tons of low-grade ore were crushed, the average contents of which were 0.137 oz. of gold per ton and 0.5% copper. The 1658 tons of concentrates produced from this tonnage averaged 1.96 oz. gold, 0.643 oz. silver and 1.14% copper, or $25.75 per ton. The tailings averaged 0.034 oz. gold and 0.56% copper. The cost of concentration was $1.06 per ton treated. The smelting charges, direct and indirect, amounted to $6.77 per ton of concentrates.

Preparation of Rock Sections

By Arthur L. Flagg*

The value of the study of rocks and ores in thin sections under the compound microscope is not a topic that admits of much debate. No doubt such study would be more general among engineers who are interested in this phase of geological research were it not for the general impression that thin sections are difficult to prepare. There is no reason why any engineer should not prepare his own slides, for the operation is not so difficult as it would seem and is really interesting.

Before discussing the actual preparation of the section it will not be out of place to say a few words about the selection of material. It is desirable to have fresh, unaltered specimens to select from, though in the case of ores, altered material may be more desirable in some instances. The chip from which the slide is to be made should be as thin as possible at the beginning and not over an inch square. In breaking it out, use a quick, well directed blow from a hammer with a sharp peen or from a cold chisel, in order not to bruise the chip or to fill it with cracks. The larger sides of the chip should be at least roughly parallel. A beginner is advised to take two or three chips in the field, in order to be sure of a section.

The only materials needed for the preparation of thin sections are No. 100 carborundum, FF carborundum, a piece of stove-plate or its equivalent, a piece of plate glass about six or eight inches square, Canada balsam (preferably in a collapsible tube), turpentine, chloroform (or xylol), a heating plate and an alcohol lamp, a few spring clips (spring clothespins are excellent), a small nail-brush, soap and water.

Glass Slides First Ground Flat

The first operation consists in preparing the slides which seldom come from the dealer with perfectly plane surfaces. If it is certain that the slides have a plane surface, this part of the operation may be dispensed with. In addition to securing a plane surface, grinding the slides has two other advantages: (1) The balsam used in mounting will adhere better to a ground surface; (2), there is no necessity of transferring the section to a fresh slide, since on the glass so ground, scratches are scarcely noticeable.

To begin the grinding, a small quantity of FF carborundum is sprinkled on the glass plate and enough water added to make a thin paste. The slide is then moved over the plate with a circular motion until all the clear spots, which represent depressions have disappeared. Care should be taken to work over as much of the glass plate as possible in order to preserve the uniformity of surface. After a plane surface has been secured, the slide should be thoroughly washed with soap and water, using the brush, and set away to dry. This grinding also prepares the carborundum and the glass plate. Almost invariably FF carborundum contains some coarse particles which would wreck a thin section in the final grinding stage if not removed. In grinding down the slide, these objectionable particles are destroyed, or removed if detected, and the plate is left in good condition, properly charged for the final and most delicate stage in the grinding process.

Method of Grinding by Attaching Section to Piece of Plate Glass

The section is next prepared. One face is ground down flat on the iron plate, using No. 100 carborundum with plenty of water. If irregular, it is turned over and ground until two nearly parallel faces are obtained, when it is thoroughly washed with the brush, using plenty of soap and water, to remove all of the carborundum. Grinding is then transferred to the glass plate until one surface of the section is perfectly plane, when it is again washed carefully and dried by applying gentle heat. When thoroughly dry it is placed on the heating plate over the alcohol lamp. The prepared slide is also placed on the plate, ground side up. On the center of the slide is placed a small drop of balsam, not so much that it will spread and run off, but enough to cement the section to the slide. It is heated until a bit of it, when taken up on a pin point, hardens immediately. The section with the prepared surface up is laid on a thin, narrow board. The slide is picked up with the clips, inverted quickly, so that the fluid balsam hangs in a drop near the center, and brought down steadily but slowly on the section, permitting the balsam to flow evenly over the surface of the section without including air bubbles. The slide is inverted, the chip centered as quickly as possible and the spring clip applied, together with such extra pressure as the slide will bear without breaking, since intimate contact between the slide and section is quite essential. The slide is then set aside to cool.

One Side of Section Ground and Attached to Slide

When cool, the section is ground down to the required thickness. This stage of the process requires the most skill and patience, but one will soon learn the "kinks" and rarely lose a section. The work is begun on the iron plate, the slide held between the thumb, second and third finger; while the forefinger placed directly over the center of the section, applies the necessary pressure. Grinding is continued until the balsam around

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the edges of the section has almost disappeared. To carry it to this stage, which means a thickness of about 0.001 in., the section must have been carefully centered and brought into close contact with the slide when first mounted. The section is then washed, finished on the glass plate, and washed again, thoroughly and carefully. fully.

To get rid of superfluous balsam and carborundum flour, which have become ground in, turpentine is applied a drop at a time and removed with soap and water. The section, thoroughly cleansed and dry, is then ready for the cover glass. A small drop of balsam direct from the tube is put on the center of the section and the cover glass placed on this, care being taken to exclude all air bubbles and the slide is gently warmed to soften the balsam, thus permitting the cover glass to settle into position by its own weight. The slide is then complete except for setting away out of the dust in a warm, dry place until the balsam hardens. This will take some time, as the soft balsam hardens more slowly than that previously hardened by heating, but advantages are gained in clarity and keeping qualities.

Finishing Section Requires Care

Another method of grinding, more difficult but often more satisfactory, is to cement the chip to a thick piece of plate glass, about two inches square, after the first side has been finished, instead of mounting it on the slide on which it is to be kept. The grinding is made easier in this way, but the finished section must be detached from the glass again and transferred to the slide. In this method the final washing is done before the section is removed from the glass plate, after which it is dried very carefully over the alcohol lamp, until every bit of water is expelled, or the section, when mounted, will be seriously fogged. When thoroughly dried it is ready to be loosened from the thick plate.

This is done by first moistening the top of the section with a drop of chloroform or xylol, and then dropping on its center a few drops of new balsam dissolved in chloroform. As the old balsam holding the section to the glass dissolves and unites with the new mixture, the section will become free and float on the surface. To transfer this delicate affair to the clean slide is then a simple matter, for by tilting the heavy glass plate it will slide off quite easily. By keeping the balsam fluid and manipulating the slide only, the section can be floated into the desired position without touching with the fingers or any instruments. When properly centered the cover glass is put in place, pressed down firmly into position and, after drying, the slide is ready for use.

Bill to Remove Duty on Iron Products if Price Rises

Washington Correspondence

Congressman Hobson, of Alabama, has introduced the following bill, which, it is understood, will be given careful consideration with a possible view to securing its incorporation as an amendment to the tariff bill:

That when at any time the market price of pig iron or of any article of construction material of iron or steel in Schedule C shall exceed by 50% the market price of the same pig iron or article of construction material of iron or steel on Jan. 1, 1914, then said pig iron or article of construction material of iron or steel and all materials entering into the manufacture of same shall be transferred automatically to the free list and remain upon the free list until the market price shall again reach the said limit of 50% excess, when the pig iron or article of construction material of iron or steel shall return automatically to its original dutiable status, as provided for in this bill; and the Secretary of the Treasury is hereby authorized to interpret the question of what constitutes market value and what constitutes pig iron and articles of construction of iron or steel and material entering into the manufacture of same as used in this paragraph.

Strong opposition is manifested to the measure, and the probability of its adoption cannot be gaged at present.

Bolivian 1912 Metal Production

The following statistics of the 1912 Bolivian mineral production were taken by the *Mining Journal,* Apr. 26, 1913, from the *Revista de Aduanas.* Bolivia continues to occupy the second place in the world's tin production. The amount exported in 1912 was 38,378,696 kg. of *barrilla,* with an estimated content of 60% of metallic tin. The exports figures for the last five years are given, with those of other minerals, in an accompanying table.

The figures for copper production are calculated on *barrilla* (dressed ore containing chiefly metallic copper), with an average computed content of 80% Cu. Although 15 or 20 years ago Bolivia held the second place in the world's silver production, and though there are many deposits of mineral running 30 oz. to the ton, the silver output continues to dwindle. The zinc-ore exports given are almost exclusively those of the Huanchaca company.

BOLIVIAN MINERAL PRODUCTION

Year	Tin barilla, kg.	Copper barilla, kg.	Fine silver kg.	Wolfram ore kg.	Zinc ore, kg.
1908	29,938,828	2,877,605	156,482	169,637	1,242
1909	35,566,415	3,096,605	155,360	169,866	182,895
1910	38,548,441	3,211,987	142,977	207,061	11,897,000
1911	37,073,148	2,950,024	127,990	297,272	9,798,125
1912	38,378,696	4,681,674	123,939	472,457	9,010,055

There were also exports of bismuth concentrates and ores amounting to 45,000 kg., and of 766,000 kg. of lead ores.

Van-Roi Mining Co.

The report of the Van-Roi Mining Co., Ltd., for the year ended Sept. 30, 1912, shows that the mine at Silverton, B. C., produced 57,849 tons of silver-lead-zinc ore, from which a net profit of $145,401 was realized. Development work was entirely on the main vein and totaled 4488 ft. divided as follows: Drifting, 3354 ft.; crosscutting, 117 ft.; raising, 1011 ft.; sinking 7 ft. The cost of development averaged $8.91 per foot.

In the concentrating plant, 54,115 tons of ore were treated, the average assay of which was 15 oz. silver, 3.66% lead, and 6.26% zinc. Lead concentrates to the extent of 2393 tons were produced, assaying 197.75 oz. silver; 60.2% lead and 11.1% zinc; and 2571 tons of zinc concentrates, assaying 60.8 oz. silver, 3.7% lead. and 45.1% zinc. The average assay of the tailings was 4.6 oz. silver, 0.9% lead and 4% zinc. The cost of mining was $2.68 per ton and the cost of concentrating was 95c. per ton. The former figure is slightly higher than last year, the latter remains unaltered. A new 2-bucket aërial tramway was built for the transportation of ore extracted below the ninth level. It has proved satisfactory and has a large capacity.

Smelting Precipitate at Cerro Prieto, Sonora

By H. S. Munroe*

SYNOPSIS—Refining the precipitate from an early installation where zinc dust was used as a precipitant. The process is substantially that of P. S. Taverner, although but one furnace is employed with separate bottoms for melting and cupeling. A large proportion of litharge is used in melting in addition to other customary ingredients. Oil fuel aided in reducing the expense of the process. The process is inexpensive and produces a bullion which can be introduced directly into the mint without further refining.

The method of treating precipitate in use at the plant of the Black Mountain Mining Co., Cerro Prieto, Sonora, Mexico, is direct smelting without acid treatment, collection of the silver and gold in lead and subsequent cupellation of the lead producing bullion and litharge. It was first used, to the best of my knowledge, in August, 1899, at the Bonanza, Ltd., in South Africa. The process was evolved by P. S. Taverner[1], whose description of it as then used may be found in the "Proceedings of the Chemical, Metallurgical and Mining Society of South Africa," Vol. III, p. 112. The method has since been installed at Homestake and at Black Mountain by C. W. Merrill, and more recently at the Pittsburgh-Silver Peak and also at the new Esperanza plant at El Oro, Mexico.

Lead Smelting Process of Value When Zinc Dust Is Used

While the process was first worked out on a zinc-shaving precipitate, it is of greater value where zinc dust is used. The treatment under discussion is of especial value where the precipitate is of great bulk, of low grade, and where lead acetate is used as an aid to precipitation.

Precipitation is accomplished by zinc dust in two Merrill 30-leaf filter presses, the leaves being of the square type, 32 in. on a side. The filtering medium is two thicknesses of ordinary cotton sheeting. Each cloth is used twice, the new cloth being placed under the older one, the exposed cloth at the cleanup being removed and used to wrap up fluxed product preparatory to charging into the furnace.

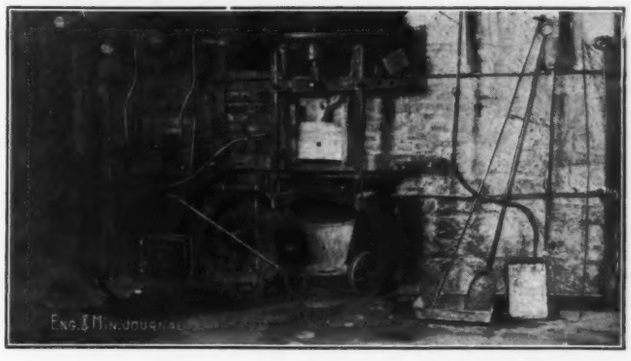
Precipitate Partially Dried over Wood Fire

The product from a press, running from 35 to 41% moisture, is scraped off the filter cloth into a pan from which it is transferred into smaller pans, five of which are placed on a carriage and run into the drying furnace. Each drying pan has a capacity of 225 lb. of wet product. It takes four Japanese workmen about three hours to break and clean two presses, replace cloths and put everything in readiness for resumption of solution flow. The presses are off about six hours at each cleanup, three hours being required to dry the cake with compressed air before the presses are broken.

Wood is used as fuel in the drying furnace, where it takes about 12 hr. of intelligent firing to reduce the moisture content of the product to about 10%. At this point the product is removed from the dryer and passed through a 6-mesh screen into the fluxing box, the floor of the latter having previously been covered with a layer of borax glass or ground assay slag. This partially dry product, assaying 35 to 45% bullion, 25 to 35% zinc and 10 to 20% lead, is fluxed as follows, the weight of the partially dry product being used as a basis for computation.

Flux Contains Much Litharge

Litharge, varying with the bullion content of the product, 90 to 120% of the weight of the precipitate; old slag from this process, 30%; borax glass, 10 to 20%, and assay slag, 30 to 20%, varying with the zinc content of the product (the combination of borax glass and assay slag is usually kept in the neighborhood of 40%); 5 to 8% coke, enough being used to reduce the litharge; 8 to 15% silica, varying with the zinc content of the product; and 5% soda. It was found that the cleanest slags and best cupeling conditions resulted when the lead bars from the melting process were kept under 225 fine. Care was taken that enough litharge was present and reduced to insure this.



Melting and Cupeling Furnace at Cerro Prieto, Sonora

The fluxes are spread out in layers over the screened product, the litharge added last, and the whole turned over from one end of the box to the other until an intimate mixture is obtained. The fluxed product is then tied up in the old filter cloths, each double cloth making eight tie cloths. Each package of the fluxed product weighs from 6 to 8 lb. The product is now ready for the furnace.

One Furnace for Both Melting and Cupeling

The furnace used for melting and cupeling is the ordinary type of cupeling furnace furnished by the Allis-Chalmers Co., and is shown in the accompanying illustration. It was originally designed to burn coal, but the fire box was remodeled for crude oil, a style A, No. 1 Leahy burner with compressed air at about 70-lb. pressure, being used. The draft is taken in through the fire bridge so that it has little cooling effect on the fire.

Both melting and cupeling are done in tests built in the ordinary test castings, the accompanying drawing showing the shape and dimensions of each. In making these bottoms, the materials used for the melting test

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[1]The Taverner process made use of two separate furnaces for the operation, a reverberatory for melting and a cupel furnace for refining.

are: 180 lb. limestone, ground through 20 mesh; 180 lb. fireclay; 60 lb. portland cement; and 60 lb. old test bottom, ground through 20 mesh; and for the cupeling test: 156 lb. limestone, ground through 20 mesh; 156 lb. fireclay; 52 lb. portland cement, and 52 lb. old test bottom, ground through 20 mesh.

In preparing these materials great care is taken to get a thorough mixture before water is added. When the desired mixture has been effected, water is added only in small quantities, the mixture being carried on simultaneously with the addition of spray water. If too much water be added, the test will crack on drying. When the material is thoroughly mixed and the right degree of moisture attained, the test casting is filled loosely and the mixture first trodden in and then rammed home with 20-lb. tampers, and finally the surface is well gone over with 8-lb. hammers. Thus the material first introduced, then filling the casting, now occupies about one-half the volume. The above procedure is the same whether the test is to be used for melting or cupeling.

Melting Test Contains Iron Liners

For the melting test more material is added and the cast-iron liners pounded home. These are cast three pieces to the set and care is taken that the joints fit snugly. A wedge-shaped piece of wood is driven in the front, the space being later filled with bone ash, and the iron plates are driven. These plates act as a false front as the bottom fluxes back to them a few hours after the test is in use. More material is now introduced and rammed roughly but firmly into the approximate shape of the finished test, the finishing being accomplished by means of a small, curved mason's trowel. Finally the whole surface is moistened and smoothed over with the same instrument, small plates are driven in the joints of the cast-iron liners, if necessary, and the job is complete. Each melting test is allowed to season from six to eight weeks before it is used.

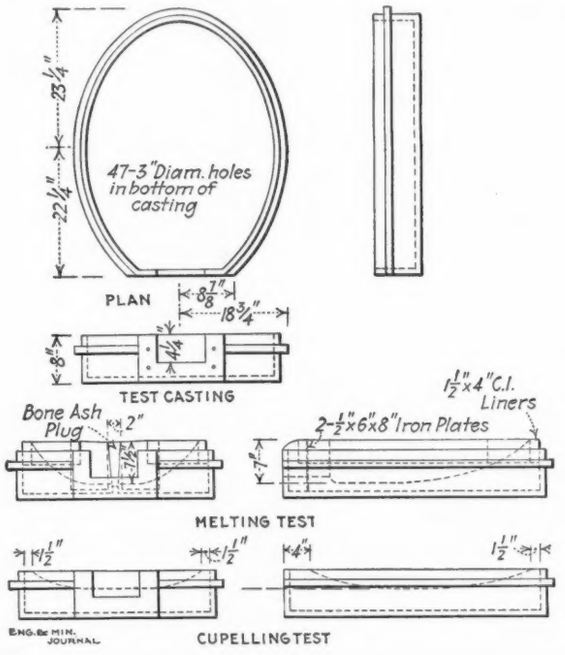
The cupeling test is far more simple, as no liners are used and no bone-ash plug put in the front. Also the shaping requires less skill. As the cupeling test is allowed to dry under the furnace for two or three days before it is used, it is only necessary to allow two weeks seasoning for each one. Before using, suitable fronts are bolted to the test, a simple cast-iron plate with a slot to allow of tapping lead being used in the case of the melting test and a water-cooled cast-iron front in the case of the cupeling test.

Bar of Pig Lead Melted First in Bottom

The melting test having been adjusted, the fire is started and carried on at full blast for about two hours or until the entire inside of the furnace on both sides of the fire bridge presents a bright-red appearance. By this time the test should be thoroughly dry and hot if it has been properly made and seasoned. A bar of pig lead is now added in two pieces, the first being allowed to melt down before the second is introduced. As soon as the second piece of lead has melted, one package of fluxed product is added and allowed to melt and when melted, is well stirred and two more packages added. Much care is exercised during this stage of the process that the product be not disturbed until at least in a pasty condition, otherwise losses by dusting will result. The product is now added in increasing amounts, as the size of the molten bath increases. When the test is full and all action in the molten bath cease, a groove is cut in the top of the bone-ash plug in the front of the test and a pot of slag drawn off, the front of the test being lowered and raised by means of the wheel and screw. The pot of slag having been drawn, the test is raised into place and the groove filled with bone ash (ground-up used assay cupels serving as bone ash) made into a thick mud by mixing with water containing about 20 grams of potassium nitrate per liter. The product is now charged about 10 packages at a time and slag is drawn at 1½-hr. intervals.

Test May Be Lowered for Discharging

When five or six pots of slag have been drawn, enough lead has accumulated in the bottom of the test to necessitate tapping it. To do this, the test is raised, the front filled and about six pounds of ground slag added to the bath in the extreme front to render it less fluid around



Melting and Cupeling Tests at Cerro Prieto, Sonora

the lead tap hole. The test is then lowered, a ½-in. hole driven through the bone-ash plug at a point about 2 in. above the bottom of the bath and two bars of lead drawn, each weighing about 80 lb. By tapping above the bottom of the bath, about 300 lb. of lead is left in the test, which has the effect of keeping the test hotter and increasing the furnace efficiency. After this, two bars of lead are tapped after every second pot of slag or oftener as occasion demands, as would be the case when the product is extraordinarily rich and a large proportion of litharge is reduced.

This procedure is kept up until all the product has been added. The inevitable slag and lead resulting from leakage, run-overs and spattering, is added to the last charge and the last pot of slag having been drawn, the test is lowered and all the remaining lead tapped into molds resting on a low carriage. The test is then raised, the front plate removed, the bone-ash plug (what is left

of it) driven out and the remainder of the slag and lead drawn into a cone-shaped pot in which the lead forms a button in the bottom.

The melting test is now lowered on to an iron carriage, taken out and run into a corner to cool and the cupeling test inserted and heated. The test is sufficiently hot in about ½ hr. and the charging of the lead bars is then commenced. Charging is accomplished through a 6-in. square hole in the back of the furnace, one man pushing the bar through the hole with a hook made for the purpose, while another, working through the front door, supports the bar until it is over the test when it is carefully lowered. Two bars are charged in succession and allowed to melt before more are introduced.

Litharge Poured off as Formed on the Bath

When the test is full of molten lead, the tuyere having been adjusted, the air is turned on until the surface of the bath is covered with a series of gentle ripples. The litharge is allowed to accumulate for about 15 min. before any attempt is made to draw it. Enough litharge having gathered in the front of the cupel, the latter is lowered and the litharge allowed to run over in a small stream.

Constant attention is given this part of the process by two men. One catches a thin layer of litharge on a shovel every few minutes as a test for metallic lead, the lead adhering to the shovel, while the litharge slides off when the shovel is tilted. To make this test well, the shovel must be kept fairly cool and dry. This test, however, with an experienced operator is merely a precautionary measure, as constant watching of the stream as it breaks over the water-cooled front will detect the flow of any metal. The second man watches and keeps free the small channel through which the litharge flows and prevents the accumulation of frozen litharge on the water-cooled front.

Much care in firing is necessary to give the best working heat without volatilization, a fairly high heat being maintained at the beginning of each drawing, and constantly throttled down toward the end. As the process proceeds and the molten solution becomes more saturated with silver and gold, greater heat is needed and at the finish of the cupellation, a high temperature is used to clean off the last vestige of litharge. Air for cupeling is furnished by a No. 3 Roots cycloidal blower.

Bullion Broken Hot and Remelted into Bars

When the bath is free from litharge, the test is lowered on to an iron carriage, drawn from the furnace and the cupeled bullion broken with straight, pointed bars, care being taken that the part around the edge of the test be pried up and broken before it becomes too cool to break easily. As the bullion is broken, it is shoveled off into iron wheelbarrows from which it is charged into an oil-burning Steele-Harvey tilting furnace, remelted and cast into bars, weighing about 2500 oz., for shipment. The final bullion is usually about 975 fine in gold and silver, though it has been run up as fine as 992 and once in 64 shipments fell below 950.

The precipitate is sampled as it is shoveled from the collecting trays into the drying trays, two portions being taken from each shovel with a spatula. It is sampled in the same manner when being transferred from the drying trays to the fluxing box. These samples are used both for moisture and assay operations and usually check within 1.5% on moisture and 2.5% on value.

For the slag sample, a succession of cuts is taken from the stream while the slag is being drawn. This is granulated in water and cut down when dry, the sample for each pot of slag being kept separate until the end of each shift, when a composite sample is made for the shift. Each shovelful of litharge is sampled as it is being charged into the flux bin.

Recovery Is Practically Complete

Four dips are taken for the bullion sample just before the bars are cast. The variation of these samples rarely exceeds 0.1%. The scrap bar is sampled in the same way.

Against the melt is charged the content of the precipitate, slag and litharge fluxes and the scrap bar. The recovery sheet is credited with the contents of the bullion and scrap bars, the slag and litharge. The recovery is from 98 to 99.5%, averaging about 98.4%. Owing to the impossibility of taking a reliable sample of the precipitate, and the variation in assay results, the estimation of recovery is only an approximation at best.

About 20% of the slag is ground and recharged to the furnace as flux. The rest is stacked in the warehouse until a carload is on hand when it is shipped to the smelter. The slags run from 1 to 2 oz. Au, 10 to 20 oz. Ag, and about 5% Pb, the average for four months being: 1.73 oz. Au; 12.45 oz. Ag; and 4.32% Pb. All the litharge is saved and used as the collector for the charge. The bar of lead charged each melt with the lead contained in the precipitate compensates the losses, keeping the litharge on hand about a constant quantity. The average assay of the litharge for four months is as follows: 16.72 oz. Au, and 147.59 oz. Ag per ton.

Oil was introduced as fuel during the month of April, materially cutting the cost of fuel and power as well as making a slight reduction in the labor item and increasing the metallurgical efficiency. The accompanying table shows the cost per oz. of fine Au-Ag bullion during the months of February and May. A comparison will show the saving effected by the use of oil. It will be noticed that during the month of May, the flux was the major item. This has been further reduced by the substitution of assay slag for borax glass, as far as the supply allows, until now the plant is operating on a basis of about $0.043 per fine oz.

COST OF MELTING AND REFINING PRECIPITATE AT CERRO PRIETO

	Fuel	Flux	Tests	Repairs and Inc.	Total Materials	Labor	Power	Assay	Grand Total
Feb.	0.027	0.029	0.003	0.017	0.077	0.024	0.010	0.001	$0.112
May	0.006	0.017	0.003	0.002	0.028	0.016	0.003	0.002	0.049

The figures in the table also include the cost of all the material and labor used in precipitation except the cost of zinc dust and lead acetate and the labor involved in charging the same into the mixing cone and pregnant-solution tank.

There are two melts per month each lasting 3 to 4 days. During the melts, each shift of 12 hr. employs one American and two Japanese. For four days after each melt, one American and three Japanese are employed grinding fluxes, making tests, etc. The rest of the time, except when repairs are necessary, the doors are closed. The zinc presses require about 10 min. attention per day.

Cyaniding Copper-Bearing Ores

A process for treating cupriferous gold and silver ores has been devised by John Collins Clancy, and he has been granted U. S. pat. No. 1,057,936, covering its use. The process consists of subjecting the ore to the action of cyanide solution containing a soluble cyanamide, the functions of the cyanamide being to prevent the precipitation of copper upon the zinc at the same time that the gold and silver are precipitating. The process may be applied by adding any cyanamide, calcium cyanamide, for instance, to the solutions with which ores are treated. The mixture of ore and solution is agitated according to the usual practice, and solution is separated by some one of the usual means. The solution is passed over zinc shavings or dust to precipitate its metal contents, while the copper is held in solution by reason of the presence of cyanamide. This solution is used over and over again, or if necessary, passed through an electrolyzer to precipitate its copper contents. The amount of copper in the solution will determine the time when the precipitation of copper should be effected. The copper-cyanamide solution is said to be an excellent solvent for the precious metals, as well as for copper compounds.

The great virtue of this process, in addition to the avoiding of precipitating copper along with gold and silver, is said to be that by simple electrolysis all of the cyanide may be regenerated at a slight expenditure of current, due to the fact that copper is first precipitated on the anode as a black copper cyanamide. This copper cynamide behaves practically as a copper anode and a low voltage is sufficient to transfer the anodic copper to the cathode, during which transfer regeneration of the cyanide takes place. In the treatment of copper sulphide ores the process works as advantageously as in the treatment of oxidized copper ores. It may be stated that a high current density may be used in the deposition of the copper from the solution without destroying the solution and at the same time cutting down the expense of large installations for electrolyzers in the copper deposition.

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Zinc and Lead Placer Mining

By Lucius L. Wittich*

Interesting mining operations have been launched in Cherokee County, Kan., to reclaim from the bed of Short Creek the zinc and lead ores that have accumulated there as the result of mining and milling operations at points higher on the stream.

The area to be covered by these operations is extensive, and the depth of the mineralized horizon is given at from three to five feet, so there would seem to be possibilities in the new mining venture. The recovery is said to run as high as 20% blende and galena. Short Creek rises at a point about one mile west of Joplin, Mo., and traverses a mineralized area, including the Short Creek bottom district of Galena, Kan.

The first milling plant to handle the material in the creek bed, was constructed by the Woods & Anthony Mining Co., holding a lease on a portion of the 320-acre tract of the Bonanza Zinc & Lead Co., one mile west of Galena. The creek there has been diverted into a new channel, which carries the water in a wide detour around its old bed. The plant is equipped with crusher, rolls, jigs, sand jigs and slime tables. The ore is scooped up with scrapers drawn by mule teams; the product is dragged to the mill, emptied into a hopper, raised by a bucket elevator and passed into trommel screens, the coarse dirt going to the crusher and rolls, while the fine passes directly to the jigs, the sand jigs, or the tables, according to its composition. The material recovered is a good galena concentrate, and a mixed blende concentrate greatly in excess of the galena output, but of a lower grade.

The mineral is not confined to fine particles; boulders of blende and calamine as large as a man's head indicate the strength of the flood waters that have swept through the channel. The greater portion of the ore, however, consists of the fine blende and galena, intermingled with coarse sand and gravel.

Below the Woods & Anthony plant, Ryan Brothers and associates have acquired a lease on overflow land from the Empire District Electric Co., and are conducting development on a somewhat smaller scale, with an equipment consisting of two slime tables, crusher and rolls. They also have diverted the course of the creek for a distance of several hundred feet and are employing mules and scrapers to get the dirt to their hopper.

*Joplin, Mo.

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Low's Combined Gas Producer and Engine

A self-contained unit for the direct conversion of coal energy into work has been invented by Dr. A. M. Low, of England. It is essentially a producer-gas engine with a compact gas producer attached to the end of the cylinder. The illustrations show a 100-hp. unit, which is successfully running, according to *Power*, Jan. 21, 1913, and is said to have developed a brake horsepower-hour on ½ lb. of coal, a remarkable performance, if true.

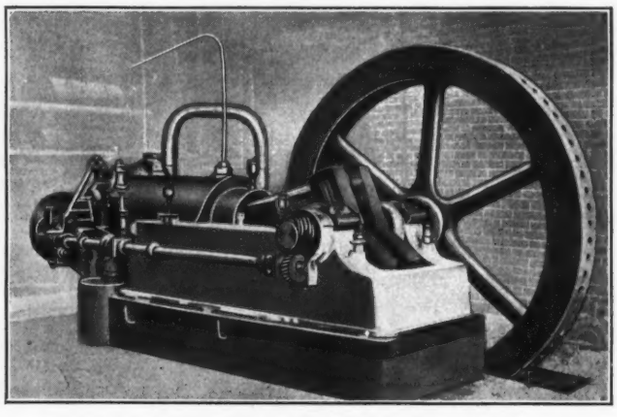


Fig. 1. The Low "Coal" Engine

Referring to Fig. 2, coal is fed into the hopper *A*, from which it is conveyed by four worms through the heater tubes *T*. These tubes pass through the gas chamber *G*, connected with the inlet valve, the exhaust-heated chamber *E*, the combustion chamber *C*, and open into the ash and soot chamber *S*. The latter is fitted with a non-return valve, which admits air or a mixture of steam and air to the tubes. This air is drawn by the suction of the engine over the incandescent coal, maintained

in this state by the heat of chambers *C* and *E*, and passes through holes in the tubes *T* into chamber *G*. It is by this time mixed with the gases given off from the incandescent coal and the mixture passes from chamber *G* through the inlet valve into the cylinder of the engine.

In starting, the coal is brought up to incandescence by running for a few minutes on illuminating or other available gas. The feed of the worms, which are driven through gearing at the right, may be adjusted to suit the load, and the coal, after it has given off all its gas, is discharged as ash into the bottom of the ash chute *S*.

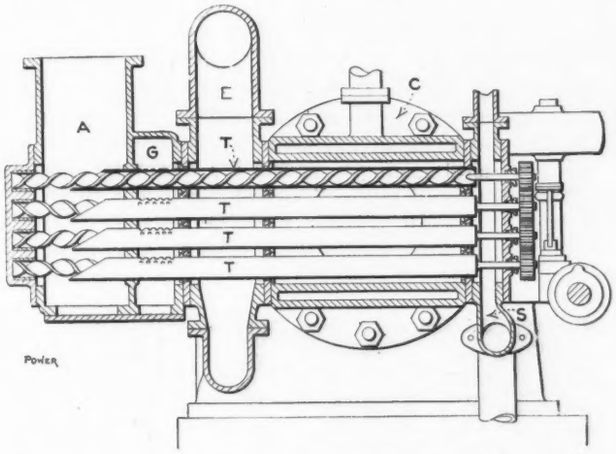


FIG. 2. COAL-FEEDING AND GAS-FORMING DEVICE

Trouble from the formation of tar, which might have been expected, has not been experienced, as the tar is not gasified, but passes entirely off as a fine yellow dust. The rapid heating of the coal in small quantities causes this, and the high temperature and relatively low compression, about 90 lb., prevent condensation and precipitation in the engine passages.

Indiana Mining Co.

The principal work during the year 1912, at the property of the Indiana Mining Co., in the Lake Superior copper country, was shaft sinking. The shaft was sunk 671 ft. at a cost of $50.80 per ft.; the total depth on Dec. 31 being 1204 ft. The depth of the shaft, Mar. 1, 1913, was 1336 ft. At a depth of 1400 ft., a station is to be cut; when this decision was first made, it was the intention to drive laterally for the lode in case it should not be cut above the 1400-ft. level. Later reports than those contained in the annual report of the president, R. M. Edwards, state that the lode was not cut at this depth, and, a few weeks ago, drifting for the lode was commenced.

The lode being sought was cut by a drill hole at a vertical depth of 1400 ft. below the surface. While surveys of the drill hole gave data from which the depth could be accurately determined, it was not possible to determine accurately the horizontal position of the lode, because of the deviation of the bore.

At the 600-ft. level, at the bottom of the first bed of felsite, 134 ft. of drifting and crosscutting was done, which showed considerable heavy copper along the contact between the felsite and underlying trap. Drifting was temporarily discontinued because it interfered too much with shaft sinking. Lateral work at this level will be resumed and will also be started at several other places in the shaft as soon as the work on 1400-ft. level is well under way. Below the 600-ft. level, showings of copper were found at several places, indicating well mineralized territory, but no lateral work was done. Several tons of mass copper were found in two small amygdaloid beds, which will be explored later. Near the bottom of the second large felsite deposit, the shaft went through 30 ft. of material, assaying 22 lb. copper per ton as carbonate.

Besides a total expense of $34,089 for shaft sinking, drifting and crosscutting 134 ft. cost $967, or $7.22 per ft. of drift. Other expenses during the year, including office, superintendence, taxes, surveying and sundries, together with $17,439, spent on construction work, brought the total up to $68,154. By the failure, Sept. 23, 1912, of Stephen R. Dow, the former president of the company, a loss of $32,702 was sustained. To meet expenses, from Aug. 1, and to provide for continuing work, an assessment of $1 per share was levied, Oct. 16, 1912, on the 80,000 shares of capital stock issued. After the resignation of Mr. Dow, new interests became identified with the company, being represented on the board of directors by Charles G. Rice and Sidney J. Jennings.

Salting Oil Properties

The ordinary engineer is familiar with most of the means for salting the metalliferous mines. An interesting exposition of the methods used in salting oil prospects is given by Dorsey Hager in the *Fuel Oil Journal*, April, 1913. A method said to have been employed by Burr Brothers was as follows: On one lease they had several fair producing wells, and more that produced little or nothing. To make a good showing for intending investors, they filled the small wells full of oil at night and started them pumping before the visiting investors were due. Pipe lines from a large storage tank were run to the casing at each well, and certain trusted employees filled the wells to the top. Fifteen to 20 min. before the visitors were to arrive at the lease the wells were started and immediately put out a good stream of oil, which lasted from 45 min. to an hour. Visitors were whisked from well to well and given no chance to return to the salted ones. By such methods thousands of dollars were obtained from investors who with their own eyes saw fine producers on the property.

A similar method consists in circulating the oil that was pumped from the well directly into the well again. By this method the well will show a continuous production and makes a fine front to examining investors. A careful study of pipe lines will of course show this crooked method, but unless one is familiar with the scheme it will prove a sure deceiver.

Another method is one in which the examining engineer does his own salting. A green engineer will hold a 5-gal. bucket at the mouth of the well and note the time required to fill it, but a number of important factors must be taken into account in figuring production by this method. Oil shrinks from 20 to 60% upon standing, due to the escape of inclosed gas. It is customary to allow the oil to settle 24 hr. and then measure the shrinkage; also to have an accurate gage, a uniform pumping speed must be maintained. Water is also present in many cases, and sand as well. Where from 15 to even 50% of

water may occur, precaution must be taken to provide against mistakes in bucket-gage testing. Of course the best method of obtaining production is to get reports of runs made to pipe-line companies and then check them up by extended tests at the wells, using both bucket and tank gages. The only accurate gage method is an actual tank test showing run over a period of a week or more, with the examiner or his representative on the ground at all hours. Wells vary greatly in their production from hour to hour, but a 24-hr. gage will be fairly constant providing the pumping speed is held constant.

Another crooked method of keeping up production is by robbing pipe-line companies of oil. This is a risky business, but is done occasionally. The pipe line is tapped at some point and oil run from the line back into the holes or tanks of the dishonest company, where it is again bought by the pipe-line company. Prospect holes are sometimes salted by filling with oil and then bailing them out for prospective investors. Such a method is crude, but has been successful during boom times. Another crude salting method was once used on a spring where there was a thick scum of heavy oil on the surface of the water and more bubbling up from below. The district was one which from its geology should not have any oil in it, but the oil was there to confute all theories. The examining engineer in this case made a midnight trip to the spring and found no oil bubbling up. Getting down on his hands and knees, he poked around the bottom of the spring and finally found a small pipe which gave a clue to the mystery. There seemed but one place the oil could come from, and that was near the top of the small knoll close by. The engineer finally found a spot that showed signs of having been recently dug up, and uncovered a barrel containing crude petroleum.

Occasionally samples of oil are switched on the examiner. Careful attention to samples will do away with such trickery. Also it is not unusual to deceive one's self as regards oil property. Thus in drilling for oil, some of the lubricant for the machinery has been known to leak into the drill hole, causing a temporary excitement, as the drillers would think the traces of oil presaged a good supply below and boomed the district on such showing. If oil has been found in quantity it nearly always shows strongly in the material dumped from the bailer, and a study of the sand pile will generally give a good clue as to whether or not oil has been found. However, the only true test lies in a careful examination and actual gaging of the well, and actual pumping tests will tell the tale, and no engineer should be content without making such a test.

Earthquakes and Structural Engineering

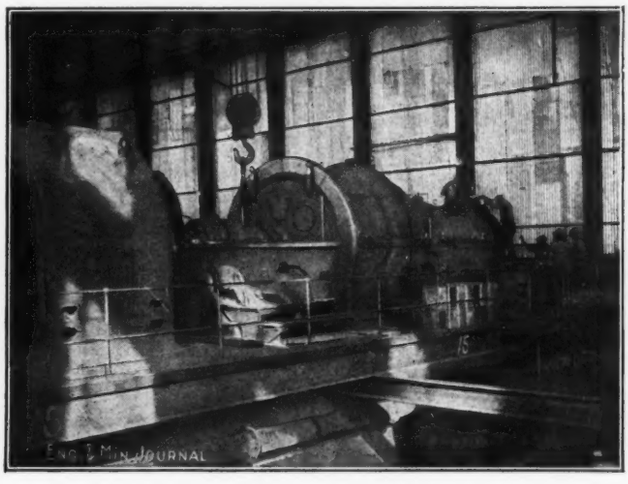
In a recent bulletin of the Seismological Society of America, attention is called to the need among constructing and mining engineers for data concerning the character and frequency of earthquakes in districts where new construction is to be undertaken. Such information is nowhere available at the present time, and cannot be until the results of the work of a large number of scattered observers are gathered together and worked up. Anyone interested in coöperating with this society should address John C. Branner, Stanford University, California.

Randfontein Central

JOHANNESBURG CORRESPONDENCE

The huge western Rand mine, the Randfontein Central, has issued a satisfactory annual report. The 752 stamps and tubes, out of a total of 1000 erected, crushed 2,573,908 tons for a yield of 23s. 11.7d. per ton, at a cost of 17s. per ton milled. Gross profit amounted to £886,399. The development work for the year was 81,445 ft., with 321,771 cu.ft. of excavation for sumps and stations. The ore reserves amount to 7,600,000 mill tons, assaying 6.2 dwt. Of this, 6,350,781 tons are valued at 28s. 10d. per ton, and the remainder is at present unpayable, valued at 13s. 7d. per ton. During 1913 it is hoped to drop all stamps and increase tonnage milled to 3,100,000 tons.

In the early part of 1912, the grade fell and profits dropped, and a change was made in the management. The present general manager reports the discovery of a new reef and the opening up of several previously known, beside the two principal reefs formerly worked. To those who believe mining on the Rand is without complications of any sort, and that development and stoping are mere

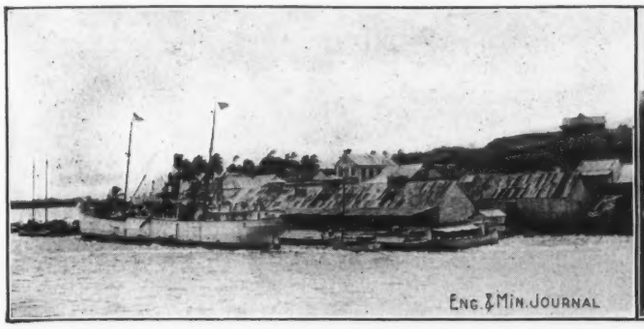


ONE OF THE TURBO-GENERATOR SETS IN PLANT OF RANDFONTEIN CENTRAL

matters of routine, it is surprising to read in the report that one former management rendered many payable stopes unpayable by taking unpayable leaders into the stope widths; that over large areas they stoped the wrong reef, leaving rich reef in the hanging wall; that much of the development was on wrong leaders, missing the pay reef entirely, and that one shaft was being sunk and timbered 20½ in. out of center.

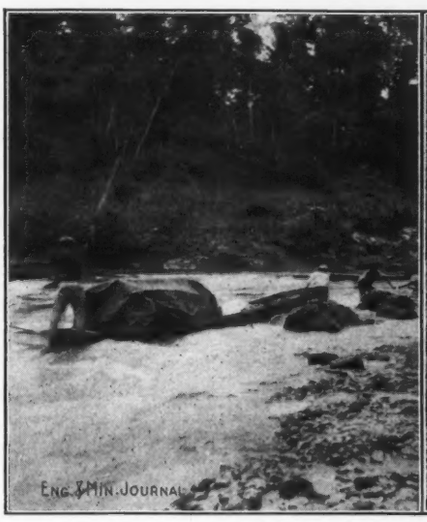
It will be remembered that the Victoria Falls Power Co. was formed to supply electrical power to most of the mines on the Rand, but that the Randfontein mines and the East Rand Proprietary Mines put up their own power plant. The plant on the Randfontein Central mine is of 20,000-kw. capacity. It supplied during the year 81,250,000 units. There are 11 substations and the cables are, unlike those of the Victoria Falls Power Co., carried underground. Stoppages occurred only on four occasions, totaling 1 hr. 15 min., as the transmission cables were protected from electrical discharges. The Victoria Falls Power Co. supplies current at 0.52d. per unit. The cost of generating at the Randfontein station was 0.246d. per unit.

PHOTOGRAPHS FROM THE FIELD



Landing at Custom House, Bluefields, Nicaragua

A Unique Use of Oxen in Nicaragua

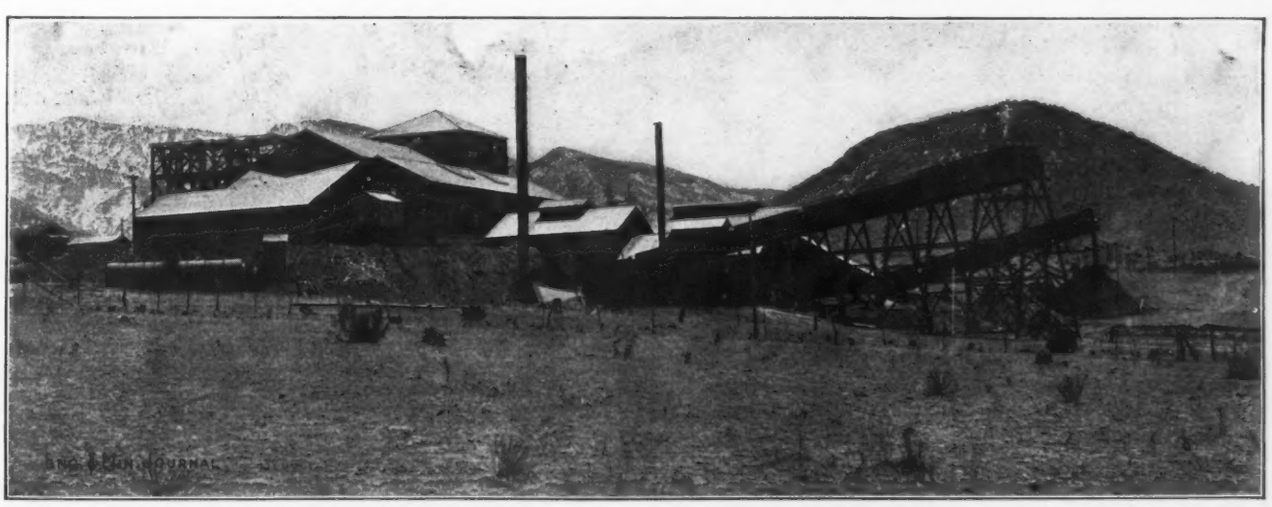


Pulling Pit-Pan Over Rapids, Prinzapulca River

Trail in Nicaragua Showing Dense Vegetation

An Opencut Mine in Nicaragua

SOME OF THE FACILITIES AVAILABLE FOR TRANSPORTING MINING MACHINERY IN NICARAGUA



NEW MILL OF OZARK SMELTING & MINING CO., MAGDALENA, N. M., FOR TREATING ZINC-LEAD-IRON SULPHIDE ORE

The Price of Steel Rails

According to James A. Farrell, standard rails have been quoted at $28 per ton for many years, but only about 30% of the rails sold in the last three years have been sold at $28 a ton. The $28 standard rail is an ordinary bessemer product. Basic, openhearth, ferrotitanium and high-silicon rails sell from $1.50 to $2 per ton more than the ordinary bessemer rails. The U. S. Steel Corporation is making about 60% openhearth rails, 30% bessemer and 10% specials, such as electric-steel rails. The corporation has an electric furnace at South Chicago where about 8000 tons of rails have been made. The corporation also manufactures manganese-steel rails, which it sells from $100 to $130 per ton.

"We have had an electric rail plant," said Mr. Farrell. "It costs $40 a ton to make those rails. We sell them at that price in order to introduce them. Nearly every trunk line has its own specifications for rails, and the prices vary accordingly. There are all kinds of alloys. We have just sold some manganese rails to the government of New South Wales at $140 a ton. Some of those used in the subway in New York cost $120. Many nickel alloy rails are used, the price running from $34 to $60.

"As to the varying specifications, the Pennsylvania Railroad, for example, has certain requirements. We fix the price accordingly, and they pay $30.55 a ton."

"How was that price arrived at?"

"By ordinary merchandising methods. They furnished the specifications, and we figured on the price. Then Mr. McCrea, late president of the Pennsylvania, sat down and bargained with me. I asked $30.85, and he said he thought we could shade it a little. We finally agreed on $30.55."

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American Zinc, Lead & Smelting Co.

The total net earnings of the American Zinc, Lead & Smelting Co. and its subsidiaries, for the year ended Dec. 31, 1912, were $400,300. These were derived from sales of zinc and lead ores, sales of spelter and sulphuric acid, and receipts from royalties, after deducting all costs of mining, manufacture, marketing, other expenses of operation, and all administrative and general expenses. From this amount, it is stated in the annual report of the company, interest on bonds and notes payable less interest received on bank deposits, amounting to $37,964, was deducted, leaving net profits of $362,335, which have been appropriated for four dividends of 50c. per share each, amounting in all to $294,880. A special reserve fund for additions and betterments to properties, amounting to $65,702, was deducted, leaving a balance of profits, of $1753, carried to surplus.

The additions to property account were made up entirely of payments for the smeltery and sulphuric-acid works at Hillsboro, Ill., and for property and development and construction expenditures in Tennessee. The plant at Hillsboro was put in commission in the middle of November, 1912, but full operations were not attained by the end of the year.

In Tennessee, large bodies of ore were developed. A shaft was sunk and a large amount of churn and diamond drilling was done to outline the orebodies. The mill and machine shop are partially built and should be completed in the near future. A large amount of development underground has already been done, so that on completion of the mill at Mascot, Tenn., the mine will be ready for operation. Power plant, spur tracks, dwelling houses, a boarding house and other necessary buildings for a mining camp have been built or are being built.

The mines in Joplin have been operated successfully during the last year, and the smelteries at Caney and Dearing, Kan., have also been operated successfully. In Wisconsin, the mines owned by the Wisconsin Zinc Co., of which this company owns 60% of the stock, have been more satisfactory than heretofore, and the outlook in Wisconsin is reported to be especially favorable.

Since the last annual meeting of the company, the capital stock has been increased by the sale of 70,000 shares, netting the company $25 par per share. Dividends have been paid not only upon the capitalization necessary on account of the properties already in operation, states the president, H. S. Kimball, but enough has been earned from the old properties to pay also the dividends upon the new capitalization. The new properties at Hillsboro and at Mascot should become earning properties this year.

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Possible Senate Changes in Metal Schedules

WASHINGTON CORRESPONDENCE

The Senate finance subcommittee has practically completed its consideration of the metal schedule and is expected to report that schedule in complete form to the full committee at an early date. The metal schedule was deemed of sufficient importance for delegation to a special subcommittee of three members, which has gone over the schedule in the House bill with great care and has given hearings to a good many metal men. It is understood that the general outlines of the schedule will be unchanged but that some important innovations will be introduced. Among these are the transfer of ferromanganese and pig iron to the free list. A change in the system of rates on lead and its products is under serious consideration, but has not, so far as can be learned, been definitely decided on. The section relating to smelting in bond is also being carefully reviewed. Some important modifications in the smelting section are looked for.

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Semiannual Report of Stewart Mining Co.

The report of the Stewart Mining Co., covering the last six months of 1912, is purely financial, small mention being made of the company's operations. There was mined during the period under consideration 97,290 tons of concentrating ore, worth $485,164, or $4.99 per ton; and 2753 tons of smelting ore, worth $105,961, or $38.49 per ton; the total receipts being thus $591,125. Costs per ton were: Mining and development, $2.15; transportation of ore, $0.15; milling, $0.35; administration and general expense, $0.31; taxes, $0.11; depreciation, $0.04, or a total of $3.11, equivalent to $310,388 for the entire tonnage mined. In addition there were litigation and miscellaneous expenses of $58,114. The resulting profit was $222,623. Since Mar. 31, 1910, the company is considered to have been in the producing class.

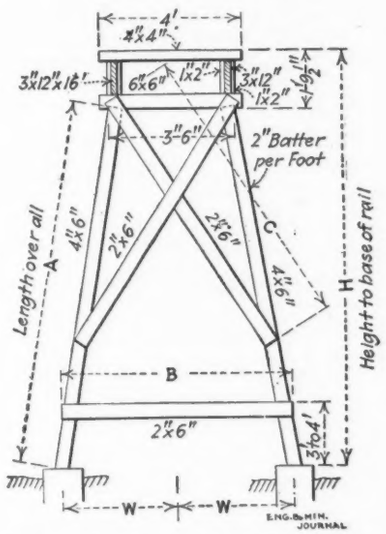
DETAILS OF PRACTICAL MINING

Tabulation of Trestle Bent Dimensions

By Clinton Kimball*

The following method of laying out and dimensioning the bents of a tramway trestle, at one of the mines in this district, was used recently by me with consequent saving of time in engineer's field work and in carpenter work. The tramway described is 1250 ft. long and constructed to carry a car having a gross weight of two tons.

The bents, as shown in the drawing, consisted of two 4x6-in. inclined posts, *A* with a 6x6-in. by 4-ft. cap and 2x6-in. diagonal braces *C* and tie pieces *B*. These bents are spaced 16 ft. between centers and carry 3x12-in. stringers; each post rests on a 12x12-in. concrete pier extending two feet below the soil surface. Each stringer



Trestle Bent, Showing Constant and Variable Dimensions

is spliced over the cap with two 1x12-in. by 4-ft. boards and diagonally braced at either end to the posts with 2x6-in. by 8-ft. pieces. Bents over 12 ft. high are connected by longitudinal 2x6-in. tie pieces placed six to eight feet below the stringers.

Stakes were driven on the center line of the proposed tramway and carefully spaced 16 ft. apart on the horizontal. A nail was driven in each stake to accurately mark the center of each trestle bent. A profile of the tops of these stakes indicating tops of piers was plotted from regular level notes. A profile of the grade of the tramway base of rail was plotted on the same sheet and the height *H* from top of piers to base of rail was thus found. This was later checked by computation. Having the distance *H* for each bent, the dimensions *A*, *B*, *C* and *W* are readily specified, using the accompanying table and interpolating. The other pieces were of constant dimensions.

*Vinegar Hill Zinc Co., Platteville, Wis.

It is desirable to keep the tops of piers at such a height that the pair supporting a bent shall have their tops on the same level and that the one on higher ground shall be nearly flush with the soil surface.

It may be seen that the framers were able to proceed

RELATIVE DIMENSIONS OF VARIABLE MEMBERS OF TRESTLE BENT FOR DIFFERENT HEIGHTS

H	A	B	C	W	H	A	B	C	W
Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.
3	1- 3	Use 4x6-in. by 4-ft. sill under posts	3-6	1- 9½	13-4	11- 9½	7-0	10-0	3- 6½
3-4	1- 7½		4-0	1-10½	13-8	12- 1½	7-0	10-0	3- 6½
3-8	1-11½		4-0	1-10½	14	12- 5½	7-0	10-0	3- 7½
4	2- 3½		4-0	1-11½	14-4	12- 9½	7-0	10-0	3- 8½
4-4	2- 7		4-0	2- 0½	14-8	13- 1½	7-0	10-0	3- 8½
4-8	2-11½		4-0	2- 0½	15	13- 5½	7-0	10-0	3- 9½
5	3- 3½	4-6	4-0	2- 1½	15-4	13- 9½	7-0	10-0	3-10½
5-4	3- 7½	4-6	4-0	2- 2½	15-8	14- 1½	7-0	10-0	3-10½
5-8	3-11½	4-7	5-0	2- 2½	16	14- 5½	7-0	10-0	3-11½
6	4- 3½	4-7	5-0	2- 3½	16-4	14- 9½	8-0	12-0	4- 0½
6-4	4- 7½	4-7	5-0	2- 4½	16-8	15- 1½	8-0	12-0	4- 0½
6-8	5- 0	4-7	5-0	2- 4½	17	15- 5½	8-0	12-0	4- 1½
7	5- 4	4-9	5-6	2- 5½	17-4	15- 9½	8-0	12-0	4- 2½
7-4	5- 8½	4-9	5-6	2- 6½	17-8	16- 1½	8-0	12-0	4- 2½
7-8	6- 0½	4-9	5-6	2- 6½	18	16- 5½	8-0	12-0	3- 3½
8	6- 4½	4-9	5-6	2- 7½	18-4	16- 9½	8-0	12-0	4- 4½
8-4	6- 8½	4-9	5-6	2- 8½	18-8	17- 2	8-0	12-0	4- 4½
8-8	7- 0½	4-9	5-6	2- 8½	19	17- 6	8-0	12-0	4- 5½
9	7- 4½	4-11	6-0	2- 9½	19-4	17-10½	9-0	14-0	4- 6½
9-4	7- 8½	4-11	6-0	2-10½	19-8	18- 2½	9-0	14-0	4- 6½
9-8	8- 0½	4-11	6-0	2-10½	20	18- 6½	9-0	14-0	4- 7½
10	8- 4½	5-3	6-0	2-11½	20-4	18-10½	9-0	14-0	4- 8½
10-4	8- 8½	5-3	6-0	3- 0½	20-8	19- 2½	9-0	14-0	4- 8½
10-8	9- 0½	5-3	6-0	3- 0½	21	19- 6½	9-0	14-0	4- 9½
11	9- 4½	5-7	7-0	3- 1½	21-4	19-10½	9-0	14-0	4-10½
11-4	9- 8½	5-7	7-0	3- 2½	21-8	20- 2½			4-10½
11-8	10- 0½	5-7	7-0	3- 2½	22	20- 6½			4-11½
12	10- 4½	6-0	8-0	3- 3½	22-4	20-10½			5- 0½
12-4	10- 8½	6-0	8-0	3- 4½	22-8	21- 2½	8 ft.		5- 0½
12-8	11- 1	6-0	8-0	3- 4½	23	21- 0½			5- 1½
13	11- 5	6-0	8-0	3- 5½	23-4	21-10½		12 ft. and a lower diagonal	5- 2½
					23-8	22- 2½			5- 2½

with the bents independently of the erectors. The method is recommended even for tramways a few hundred feet in length and especially in cases where an old tramway must be replaced, allowing a minimum of time for the shutdown incident to replacement, since piers can be set and all framework prepared to dimension before interfering with operations.

Armoring Electric Cables in Shafts

The conditions governing the installation of an electrical cable in a mine shaft differ from those governing its installation in an underground haulageway. In a paper read before the Association of Mining & Electrical Engineers, of England, Feb. 7, 1913, E. Kilburn Scott argues against the use of armoring in such shaft cables. The question of weight is exceedingly important in a suspended cable, and for that reason high pressures are advisable, which cannot be properly earthed in the armoring commonly used. The weight of the armoring itself is an additional disadvantage. There is usually sufficient metal work in the shaft to serve for earthing purposes, without the use of cable armoring. Metallic cage guides would be satisfactory, iron pipes or even hoisting ropes, and lacking these an old wire rope could be suspended in the shaft to serve for the earth return.

In horizontal cables underground one of the objects of armoring is to prevent injury from falling rock or from derailment. This possibility is more remote in a shaft, as is also the possibility of contact and consequent in-

jury to human beings, or to animals. The objection to the use of an old wire rope for a ground return in a horizontal passage, is that a break in its continuity may not be noticed. This would be impossible, of course, where it is suspended. Finally, it is easier to supply a shaft cable in the long lengths necessary where armoring is omitted.

Where armoring is applied the usual type consists of two layers of round wires wound in opposite direction. The wire is usually galvanized. Segmental steel wires are sometimes met with, especially on the Continent. They offer the advantage of giving a more complete cover with a less weight of steel.

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Tipple for Seven-Car Train

By J. R. McFarland*

At the Cactus mine of the South Utah Mines & Smelters, a dump is operated which unloads seven 4-ton cars at a time. The dump consists of a steel cylindrical framework of a length equal to seven cars, which rests on four pairs of rollers, as shown in Figs. 2 and 3. Rails on which the cars are run in are laid in the bottom. Two angle irons run the full length on the inside of the top in such a position as to embrace the tops of the cars, as can be seen in the illustration. An air-driven engine placed opposite the side of the cylinder, drives a drum carrying a wire rope which is also wrapped around the cylinder.

The motor brings a train of 14 cars from the mine and backs seven cars into the dump, the engine is started and the cylinder rolled over to the position shown in Fig. 3, with the inverted cars resting on the angle irons inside the frame. It is then rolled back, righting the cars, which are run out by the motor, and the other seven cars run in and dumped. This arrangement which has proved itself a valuable time saver, was built by Silver Brothers, Salt Lake City, Utah.

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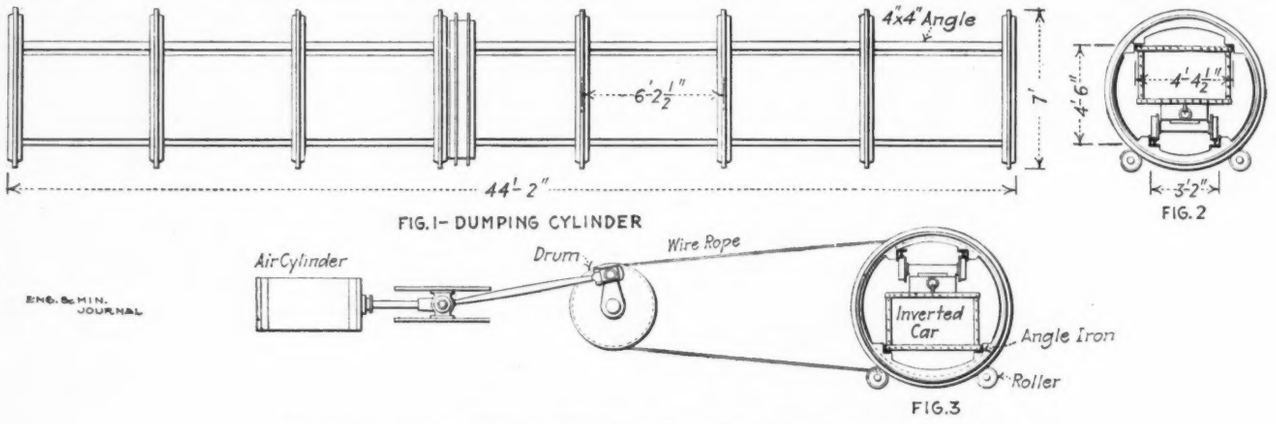
The Permanency of Concrete is sometimes urged against its adoption for structures where changes in the future are anticipated. Reinforced concrete especially has been considered objectionable, inasmuch as it is extremely difficult to remove. However, the necessity of wrecking reinforced-concrete structures has led to the adoption of special methods and in "Engineering Record," Feb. 15, 1913, the oxy-acetylene torch is mentioned as being an efficient device not only for cutting the reinforcing steel, but for disintegrating the concrete itself in a rapid manner.

*Keith Apts., Salt Lake City, Utah.

Strength of Drain Pipe

By A. O. Anderson*

While the design and testing of pipe for its bearing strength may seem quite foreign to mining engineering, yet there are occasions when some information concerning this subject will be valuable, especially if the mining engineer has some project in hand which involves the use of drain title or sewer pipe. But little has been done toward the investigation of the stresses to which pipe are subjected when placed in a trench, perhaps because it has been a current opinion that the filling material would arch over the pipe and thus relieve it of any pressure which might be caused by the weight of the fill. However, a large number of cracked and broken sewers have been found whose failure can only be assigned to the fact that the pressure caused by the weight of the filling material was greater than the bearing strength of the pipe. Recent experiments at the Engineering Experiment Station, Ames, Iowa, has yielded a large amount of information and data concerning these stresses and it is from the work done there that the data and formula given herein are based.



Cylinder for Dumping Simultaneously a Train of Seven Cars

The theory of earth pressures on pipe was discussed fully by Prof. A. Marston in the paper read before the American Society for Testing Materials at the 1911 session and was published in the proceedings of that society for the year 1911. A bulletin covering the details of these tests will be printed in a few months. The important principles involved are as follows:

(1) The load carried by a pipe in a trench depends upon the weight of the filling material in pounds per cubic foot, upon its coefficient of friction and the ratio between the depth of fill on the pipe to the width of the trench at the crown of the pipe.

(2) The load carried by a pipe in a trench is quite independent of the size of the pipe, as in a trench of unit width and depth of fill the load on a small pipe will be the same as that on a large one.

(3) When the depth of filling on a pipe is less than or equal to its width at the top of the pipe, practically all of the weight of the fill is carried by the pipe. The proportion of the weight decreases until the depth of filling equals 10 times its width at the crown of the pipe, after which there is practically no increase of load with increase of depth.

*Ames, Iowa.

(4) Tamping the filling material will not increase the bearing strength of plain cement or clay pipe, as its horizontal deformation before rupture does not usually exceed two or three hundredths of an inch. The effect of tamping the back filling is that of narrowing the width of the trench to that of the outside diameter of the pipe and so would save a pipe which would fail in the wide trench but would support the earth pressure if placed in a narrow one.

The following formulas will be of value in the design and inspection of plain clay and concrete pipe. They are derived from the formula for calculating the modulus of rupture of pipe when tested according to the "Ames" method, which has been adopted as the standard official method by the engineering and track associations of Iowa.

The thickness of a pipe when the modulus of rupture of the material and the load per linear foot to be carried are known may be found by this formula.

$$T = \sqrt{\frac{RSF}{12\,M}}$$

T = The required thickness in inches.
R = Radius of the pipe in inches.
S = Load to be carried by the pipe in pounds per linear foot.
F = Factor of safety.
M = Modulus of rupture of the pipe in pounds per square inch.

The load to be carried by the pipe should be calculated for each case according to the methods advised by Professor Marston in "Proceedings American Society for Testing Materials," Vol. XI. For approximate values which will give a general idea of the range in earth pressures, the following table is inserted which gives the approximate weights resting on pipes in trenches due to a filling of saturated yellow clay in pounds per linear foot.

Approximate Weights Resting on Pipes in Trenches Due to Saturated Yellow Clay. Pounds per Linear Foot.

Depth of Fill Above Top of Pipe, Ft.	Width of Trench in Feet at Top of Pipe			
	1	2	3	4
2	210	470	730	1000
4	340	840	1340	1870
6	430	1140	1890	2630
8	490	1380	2350	3360
10	520	1570	2750	3980

The value for the factor of safety ranges from one to six or more, depending upon the depth of fill and the quality of the pipe. In shallow fills a larger factor of safety should be used than for deep ones, since in the former case the pipes are more susceptible to pressures caused by the placing of heavy loads over the trench such as piles of brick or the passing of a traction engine. Soft porous material is seriously weakened when saturated for a long time, so pipe of this character requires a higher factor of safety than pipe made of a dense impervious material.

The modulus of rupture can best be determined by testing pipe of the size and material to be employed according to the "Ames" method. In the absence of more precise data the following values may be employed, but at their best they are inferior to data secured from tests as above suggested: 1:3 concrete pipe 30 days old, 600 lb. per sq.in.; hard burnt common clay pipe, 800 lb. per sq.in.; vitrified sewer pipe, 1000 lb. per sq.in. Small pipe will give higher values than these, while large pipe are apt to run below them. Thick-walled clay pipe usually shows a lower modulus of rupture than thin ones and this is true to a lesser extent with cement pipes.

As an illustration of the use of this formula the following problem is given: Given a 36-in. pipe to be made out of material having a modulus of rupture of 1200 lb. per sq.in., which is to be installed in a trench cut in yellow clay 13.5 ft. deep and 4 ft. wide. Required its thickness if the factor of safety is 2? Here $R = 18$ in., $M = 1200$, $F = 2$, and $S = 3980$ (taken from the table under width of 4 ft. and depth of fill 10 ft.) Then

$$T = \sqrt{\frac{18 \times 3980 \times 2}{12 \times 1200}} = 3.14\ in.$$

If the formula for the modulus of rupture be solved for S instead of T, a method will be secured for estimating the probable bearing strength of pipe whose modulus of rupture is known. Its form will be

$$S = \frac{12\,M\,T^2}{R}$$

the letters having the same meaning as heretofore stated excepting that S is bearing strength of the pipe and R is the radius to the middle line of the wall. The value of this formula is shown by the following problem: Given a 16-in. vitrified pipe having a wall 1.1 in. thick. Required its bearing strength. Taking 1000 lb. per sq.in. as the modulus of rupture and substituting the formula $M = 1000$, $T = 1.1$ in., and

$$R = \frac{16 + 1.1}{2} = 8.6\ in.$$

$$S = \frac{12 \times 1000 \times 1.1 \times 1.1}{8.6} = 1688\ lb.\ per\ linear\ foot$$

Where one is acquainted with the material in the pipe, quite accurate results may be obtained, since the modulus of rupture is the only uncertain factor involved.

When installing pipe, care should be taken to bed it carefully and the trench should be dug as narrow as possible since a slight increase in width makes a large increase in the load that must be carried by the pipe.

Emergency Pump Repairs

Two emergency repairs were recently made to pumps in an Australian mine. In one case the whole stuffing-box blew out of the cover of the water cylinder of a duplex pump, says W. Vincent Treeby in *Power*, Apr. 29, 1913. When the engineer reached the pump room the water was 2½ ft. deep and rising rapidly. Two screw jacks were made of ⅝-in. round iron, pointed at one end and screwed into a long nut at the other end. The broken parts were treated with white lead, pushed back with packing in the stuffing-box and the screw jacks placed in position between the broken stuffing-box and the steam-cylinder cover. This job made good until the receipt of a new cover and stuffing-box from Sydney.

On another occasion, a direct-acting steam pump lost the water on one side and the piston broke the cylinder head. The cylinder had a bore of 12 in. The cover was broken into three pieces, equally divided at almost 120° each. The three pieces were clamped together in a lathe chuck and a groove six inches in diameter was turned on its face. The broken surfaces were painted with red lead and a mild-steel ring shrunk into the groove. This job held against a pressure of 135 lb. per sq.in. until a new cover was received.

Dredge Spuds on the Canal

In the manufacture of new forward spuds for the Atlantic division dipper dredges, "Mindi" and "Chagres," it has been found necessary to resort temporarily to the use of native wood, owing to lack of other timber of suitable size in the Canal stock piles. The native timber is obtained from large trees found here and there in the vicinity of Gatun dam. They are cut down, hauled by rail to the Cristobal marine shops, and shaped to the required size. The wood is fairly close grained (*Canal Record,* Apr. 30, 1913), slightly resembles oak, but is full of sap and does not have the resisting power of Douglas fir or yellow pine, the wood commonly used for this purpose. Spuds made of this native wood do not last long, and serve only as temporary substitutes. In order to strengthen and keep them in service as long as possible, the plan has been adopted of encasing spud timbers, American, as well as native stock, in iron plates made into a continuous piece by welding together short lengths in the smith shop at the drydock plant. Each of these plates, when finished, is ¾ in. thick, 36 in. wide, and 48 ft. long. The plan of using plates has also been tried on some of the spuds on the dredges in the Pacific entrance to the Canal, but the welding in this case was done in the United States.

The plates, four to each timber, will give an added weight to each of the new spuds of about nine tons, making the total weight of the longer pieces over 20 tons each. The spuds used on the dredge "Mindi" are 40x40 in. square, and 57 ft. long; those on the "Chagres" are 36x36 in. square, and 68 ft. long. New spuds for these two dredges are being formed out of four timbers, cut from native stock, and securely bolted together. When the heads of the bolts are sunk on the timber, the holes are capped with pieces of wood to prevent the exposed surfaces from corroding. In addition, a spud is being made for the "Chagres" out of a single piece shipped from the United States.

The life of a spud timber varies, and depends in a great measure on the strain to which it may be subjected. During the past two years, the "Mindi" has broken nine, and the "Chagres" 19 spuds. The greater breakage in the case of the "Chagres" is mainly due to the fact that its spuds are considerably longer than those of the "Mindi," and, in consequence, are subjected to a greater strain; also, that the sectional area of its spuds is smaller.

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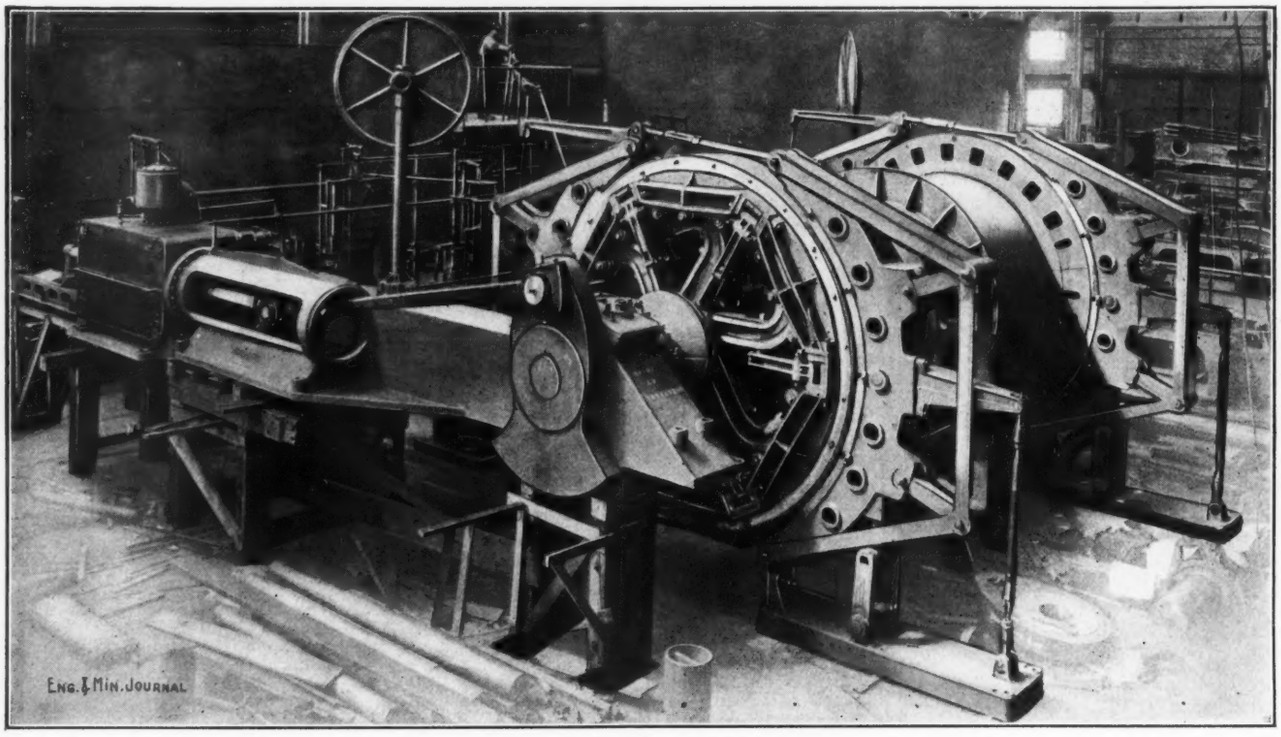
Powerful Hoist for Incline

Mention was made in the JOURNAL of Feb. 1, 1913, of a large Nordberg hoist, ordered by the Inverness Railway & Coal Co., of Inverness, Cape Breton Island. A photograph of this hoist, erected in the shop, is shown herewith. It has two 34x34x72-in. cylinders, and two 10-ft. drums clutched to the shaft. These are each capable of handling 10,000 ft. of 1½-in. rope. The load consists of 12 cars, weighing altogether 40,680 lb. loaded. The rope weighs 35,500 lb. The dip of the incline is 16° at the surface and is expected to be 35° at the bottom. The present depth is about 6000 ft. The starting stress on the rope will probably be about 41,000 lb., which the hoist can handle out of balance. The machine is said to be the largest colliery hoist in the world. The man in the upper background gives a good idea of the size of the machine.

One point of interest in connection with this installation is that an American manufacturer was able to land the contract in competition with European manufacturers in spite of a preferential duty on English machines.



LARGEST COLLIERY HOIST IN THE WORLD

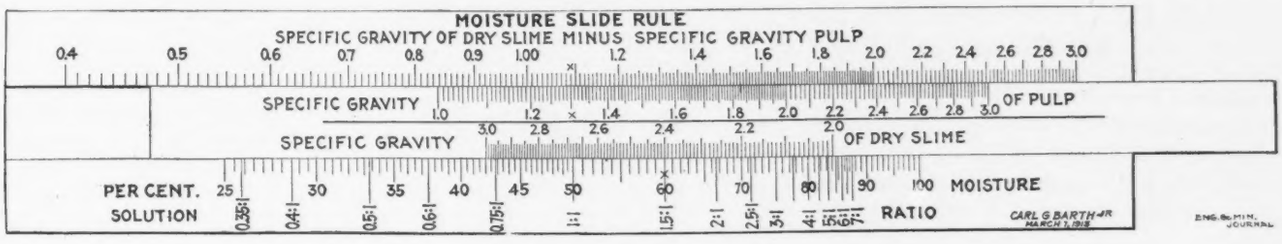
DETAILS OF METALLURGICAL PRACTICE

Moisture Slide Rule

By Carl G. Barth, Jr.*

The calculation of specific gravity and dilution ratios is constantly necessary in various branches of metallurgy, and is usually simplified by the preparation of special tables for each case. It having been found that tables are inconvenient and cumbersome to compile, a moisture slide rule has been devised to apply to slimes ranging in specific gravities from two to three, which will cover any requirements of mills handling either gold or silver ores. The rule consists of four scales, No. 1, giving values for the difference between the specific gravity of the dry slime and the specific gravity of the pulp; No. 2, giving values of the specific gravity of the various pulp mixtures; No. 3, giving values of the specific gravities of the dry slime; and No. 4, giving the percentage of moisture and the corresponding solution ratios.

To use the rule, first determine the difference between the specific gravity of the dry slime and the specific gravity of the pulp mixture and locate this on scale No. 1; then slide scale No. 2, so the value for the specific gravity of the pulp coincides with it; then locate the value for the specific gravity of the dry slime on scale No. 3 and opposite this on scale No. 4 will be found the required percentage of moisture.


MOISTURE SLIDE RULE
SPECIFIC GRAVITY OF DRY SLIME MINUS SPECIFIC GRAVITY PULP
0.4 0.5 0.6 0.7 0.8 0.9 1.00 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0
SPECIFIC GRAVITY
1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0
OF PULP
SPECIFIC GRAVITY
3.0 2.8 2.6 2.4 2.2 2.0
OF DRY SLIME
PER CENT. SOLUTION
25 30 35 40 45 50 60 70 80 90 100
MOISTURE
0.35:1 0.4:1 0.5:1 0.6:1 0.75:1 1:1 1.5:1 2:1 2.5:1 3:1 4:1 5:1 6:1 7:1
RATIO
CARL G. BARTH JR MARCH 7, 1913
ENG. & MIN. JOURNAL

Moisture Slide Rule

As a concrete example, find the percentage of moisture and the ratio of solution to slime of a pulp mixture whose specific gravity is 1.304, when the specific gravity of the dry slime is 2.4. The difference between the specific gravity of the dry slime and the specific gravity of the pulp is 2.4 — 1.304 = 1.096. Set 1.304 on scale No. 2 against 1.096 on scale No. 1 and opposite 2.4 on scale No. 3, we read 60% moisture, or, on scale No. 4, a ratio of solution to slime of 1.5 to 1.

The use of this rule will result in a saving of time and will be generally a convenience. It will be manufactured commercially and offered to users in the near future.

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The Investment of the U. S. Steel Corporation at Gary, Ind., represents an expenditure of $80,000,000. About $7,500,000 has been spent at the new steel plant at Duluth and $2,000,000 more has just been appropriated for it. This plant is to supply Minneapolis and St. Paul; also Winnipeg, Calgary and the Canadian Northwest. The reconstruction of the plant of the National Tube Co. at McKeesport, Penn., cost $13,000,000. The new steel mills at Lorain, near Cleveland, cost $15,000,000.

*Philadelphia, Penn.

Extinguishing Fires with Sawdust

The subject of the control and extinguishing of fires is of interest in all industries, and the development of a new system which promises additional efficiency will be generally considered. Volatile and inflammable materials, such as gasoline, varnishes, lacquer and other similar products, have always been more or less dangerous to handle and fires in them have been difficult to extinguish when once started. Extinguishing fires in material of this kind with a product which is itself inflammable is apparently a paradox, but in the *Metal Industry* for March, 1913, a record of tests made, using sawdust as an extinguisher of fires occurring in lacquer, is described. These lacquers are volatile and inflammable compounds, and while their exact composition is not known, in this case it is stated that they were amyl acetate-pyroxylin lacquers thinned with the usual thinners such as wood alcohol and benzine. Tests were made on the extinguishing of fires in pure gasoline, a substance about as inflammable as anything at present in industrial use.

These tests were all made in tanks containing various depths of the lacquer and gasoline and were conducted out of doors while a rather high wind, 19 miles per hour, was blowing.

It may be said here that the tanks used in the tests were three, each built of sheet steel and reinforced with angle iron. The largest was made 60 in. long, 30 in. wide and 16 in. deep; the medium tank 48 in. long, 14 in. wide and 16 in. deep, and the smallest one 30 in. long, 12 in. wide and 16 in. deep.

Both softwood (pine), and hardwood (oak), sawdust were used, and in order to determine if there was any difference between the action of absolutely dry and partially moist sawdust, one barrel was thoroughly dried. Also in order to test the advantage of using a proportion of sodium bicarbonate with the sawdust, a portion was thus mixed. The fires were started in the tanks and the extinguisher applied by means of a snow shovel having a steel blade 11 in. wide and 15 in. long, and provided with a handle 4 ft. long. An effort was made to have the lacquer thoroughly ignited and burning freely before any extinguishing medium was put upon it.

The fires were all extinguished in from 8 to 25 seconds, using the sawdust. The sawdust containing the addition of bicarbonate, in a 1 to 3 mixture, performed

the extinguishing much more rapidly than the sawdust which did not contain it. These fires were extinguished in 8 or 9 seconds. In making some tests with sand and ordinary fire extinguishers, each of these was found to operate much more slowly than sawdust.

The conclusions are that sawdust, if spread over the surface, will readily and successfully extinguish fires in inflammable liquids, particularly lacquer, when contained in moderate sized tanks, such as are ordinarily used in manufacturing plants, or small fires in these liquids on the floor. Gasoline fires in tanks were extinguished without difficulty, but there may have been some question as to whether sawdust would have worked equally well on very large tanks. The efficiency of the sawdust is undoubtedly due to its blanketing action in floating for a time upon the surface of the liquid and excluding the oxygen of the air. Its efficiency would be greater on viscous liquids than on others.

The sawdust itself is not very easily ignited, and when it does become so, burns without flame. The character of the sawdust, whether from softwood or hardwood, appears to be of little or no importance. The amount of moisture contained in the sawdust is apparently not a factor. The dry sawdust which was used in some of the tests was prepared in order to represent the condition in which sawdust might be found after having been stored in a heated mill for some time. This material, however, was as efficient as the untreated sawdust.

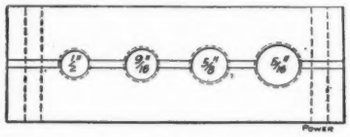
The depth of the lacquer in the small-sized tank was of no importance. Although no tests were made with varying depths in the medium-sized tanks, judging from the time it took to extinguish comparative fires in the small and medium tanks, it was quite probable that the depth would not have been a factor. This assumption is reasonable, because the only way in which increased depth could be a handicap would be in allowing the sawdust to sink and expose a fresh surface of liquid before the fire had been extinguished at all points. Whether this occurred would depend upon the length of time necessary to extinguish the fire, since the sawdust requires an appreciable time before it starts to sink.

Sand is not satisfactory for extinguishing fires in lacquer or other light and inflammable liquids, because, being heavy, it sinks to the bottom and does not have the blanketing action presented by sawdust. The sawdust can best be applied by means of a long-handled, light but substantially built shovel with a blade of sufficient area to allow taking up a considerable quantity of the material. A long handle is necessary to allow the operator to stand at some distance, as in some cases the fires were so hot that it was not possible to work at close range.

The admixture of sodium bicarbonate very much increases the efficiency of the sawdust. The effect of the carbon dioxide was clearly noticeable in the test, in that the flames occasionally made an effort to shoot sidewise and up from under the blanket of gas. It is probable that the bicarbonate mixture would have shown up to still greater advantage had it not been for the wind, which must have blown the gas away. A further advantage of the addition of the bicarbonate is that it will greatly decrease the possible danger resulting from the presence of sawdust in mills. It would be very difficult, if not impossible, to ignite the mixture by a carelessly thrown match or by any other ready source of ignition. There is a possibility that some difficulty might arise from the caking of the bicarbonate but if that should prove to be the case it could easily be overcome by the addition of about 10% of iron ore.

Holder for Threading Stud Bolts

The difficulty of making a stud bolt without special tools is well recognized. The accompanying drawing represents a method recommended by J. L. Harpole (*Power*, May 27, 1913). It consists of two pieces of machine steel, 1x1x6 in. These are clamped together with a ⅛-in. strip between, and several holes of the commonly used



HOLDER FOR THREADING STUDS

sizes of bolts, say ½- $\frac{9}{16}$-, ⅝- and ¾-in., are drilled and tapped as shown. The thin strip is then removed and two holes drilled in the ends at right angles, through which $\frac{5}{16}$-in. bolts can be slipped. Any stud to be threaded can be inserted in the proper-sized hole and the pieces clamped tight in a vise, when the unthreaded hole can be close-threaded. A similar method involves the use of a nut of the same size as the stud to be threaded, which is split and clamped over the threaded portion of the stud by a vise.

Intermittent Sorting Belts

At the No. 5 shaft of the Crown Mines, Ltd., on the Witwatersrand, the ore is delivered from the skips to two sets of grizzlies, the upper of which is spaced wider than the lower. The oversize from both grizzlies, 2 in. and up, is delivered into bins whence it is fed to the sorting belts. It is washed, as it is fed, in a chute fitted with sprays and having a bottom fitted with grizzlies of fire-bar section to remove the coarse particles, slime and water. The wash water is delivered by a high-lift, 5-in. centrifugal pump supplied from the mine-pump column.

The four sorting belts are 36 in. wide, have an inclination of 14° and are run at a speed of 150 ft. per min. Each belt is driven by a 25-hp. motor running at 500 r.p.m. through a 60 to 1 reduction gear to the head pulley of the belt. By means of a friction clutch, the belts are stopped and started at will. The object of this is to provide for a thorough sorting of the belt contents in sections. A belt full of rock is run out and stopped. It is then the duty of each sorter to pick the belt clean of waste immediately in front of him. When the overseer is sure the belt is clean, he marks the point up to which it has been picked, sets the belt in motion, and stops it again when the mark reaches the limit of picking on the other end. The waste is placed on the under side of the belt and delivered into a bin. One sorter is employed on the waste side of each belt to sort back any ore that may have been accidentally discarded.

The tube-mill pebbles are also picked out and deposited on another belt situated under the sorting belt and running diagonally across and under the sorting floor so as to be accessible from all four sorting belts.

NOTES FROM CURRENT LITERATURE

Utilizing Titaniferous Magnetites for Tool Steel

The difficulty of using magnetites in the blast furnace, when high percentages of titanium are present, is well recognized. In the *Transactions* of the Canadian Mining Institute for 1912, J. W. Evans describes the application of the Evans-Stansfield electric furnace to the production of high-class tool steel direct from titanium-bearing magnetites. It is stated that the results of test runs showed that it was possible to make a superior quality of tool steel in this manner, costing in a 5-ton furnace, not more than 3c. per lb. Any required carbon content in the steel may be obtained by regulating the quantity of carbon used in the briquettes which are charged to the furnace. No deoxidizer, such as ferromanganese, or ferrosilicon, is necessary. These steels, when high in carbon, are claimed to be almost equal to the high-speed air-hardened steels, which cost about 60c. per lb. The cost of materials, briquetted and ready for the furnace, including the items of ore, charcoal, lime, pitch, tar, etc., is $99.70 per 12 tons of ore. The cost of reduction and smelting, including labor and power, is $109, giving a total cost of $208.70. From this 12 tons of ore, five tons of steel ingots are obtained, the cost per pound thus being 2.09c. This cost includes a charge for interest and depreciation of 10% per year on $30,000, which is estimated to be the cost of a plant consisting of two five-ton furnaces.

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The Mica Market

Mincing Lane, London, is the market for nearly all the mica produced in India, says Abner L. Dixon "Bull. A. I. M. E., May, 1913. Every three weeks there is a sale in London by the produce brokers. Two days before the sale, the brokers have samples of various grades of mica from each shipment on show at a warehouse. These samples are carefully inspected by the mica buyers, and the shipments are sold at auction on the third day. At these sales Indian mica predominates; smaller lots from South Africa, Australia, Ceylon, Japan, Mexico, Bengal, and Canada are sporadically offered. Most of the mica imported into New York is purchased in London, but mica is sold on contract by large purchasers in India to Germany and the United States direct. On account of the personal factor in grading mica, there can easily be an honest difference of opinion whether a lot is up to standard or not; and to sell by any other method than open auction is a matter of some difficulty. At nearly every sale some utterly worthless mica appears, shipped from some out-of-the-way corner of the world by some ignorant but hopeful individual, who has heard of the value of mica but does not understand the qualities required to make it marketable. Most of the Indian shipments are made by 10 or 12 firms who mine for themselves and purchase from the small producers. The artificial fluctuation brought about by the speculators and the fluctuating demand for each variety make it difficult for even the best informed to give more than a rough estimate of what a given lot of mica should bring. Giving statistics of the value of mica by the ton without regard to size or quality, as is the custom, may be interesting as showing the state of the industry, but can give no one an idea of what a particular lot will fetch.

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Gold Recovery by Volatilization

A method which is being tried out at the Gwalia Consolidated mines, in the East Murchison gold field of Western Australia, for the treatment of refractory gold ore, is described by Ben Howe, in the *Monthly Journal* of the Chamber of Mines, of Western Australia, December, 1912. The process has already passed the laboratory stage and is running with a small furnace. The results were so good, the extraction varying from 92 to 94%, that a large furnace is now being erected.

The process consists in roasting the ore with a small percentage of salt, whereby the gold is volatilized and passes off as fume. The fumes are led through chambers and drenched with water, which dissolves lime, arsenic and iron salts in the fume and leaves the gold suspended in the solution as a black powder. This water is pumped through a filter press before returning to the chamber to attack more fume. The black gold slime remains in the filter press, from which it can be removed at any time and smelted.

Ore as coarse as 20-mesh has been successfully volatilized, but the finer the ore the quicker the volatilization. The salts may be mixed with the ore dry, or the ore may be wet crushed in salt water and subsequently dried. If the ore is given a rough preliminary roast before the addition of salt, 1 to 2% is sufficient for most ores, but if mixed with the raw ores more salt, say 3 to 4%, is necessary.

The furnace used is the simple brick-lined rotary type, without ribs or other projections inside, with a constant feed at one end and a discharge at the other. The temperature required is about 1000° C. A higher temperature than this sinters the ore. This is no disadvantage if it occurs at the discharge of the furnace, but if too high a temperature is carried back into the furnace the ore sinters at this stage and volatilization ceases before the ore is ready for discharge. A low temperature is fatal to good results, as little action seems to take place below a bright red heat. It is advisable to use oil or gas firing in the furnace, because the temperature is more easily under control and because the fuel, under this mode of firing, gives no soot.

The water used in breaking down the fumes becomes charged with sulphurous and a little hydrochloric acid, both of which are helpful in taking the salts of the base metals into solution. Owing to the constant circulation of water, no great heat is experienced in the breaking-down chambers, and wood can be used in their construction.

In concluding, the author states his belief that this method of gold recovery will cause radical changes to be made in many West Australian reduction plants. All ores carrying small quantities of arsenic, calcite, and other minerals present in most ores on these fields, are amenable to treatment. All ores of this category, whether oxide or sulphide ores, whether antimonial or cupriferous, whether graphitic or telluride ores, readily yield up their gold by volatilizing with salt.

In discussing this method in the May number of *Metallurgical & Chemical Engineering*, H. C. Parmelee calls attention to the fact that in 1897 or 1898, Edwin C. Pohle and Stuart Croasdale, then respectively chief assayer and chief chemist for the Globe Smelting & Refining Co., Denver, Colo., devised and patented a process based on the same principle as that suggested by Mr. Howe. These investigators found that gold, silver, lead and copper could be almost completely volatilized from most ores. It was necessary to have in the ore some form of sulphide in proper proportion to react with the added sodium chloride. The reaction liberated nascent chlorine, which combined with the metals to form volatile chloride. If the ore contained a high percentage of sulphide, it was first partly roasted; if it contained none or not enough, raw pyrite was added. The laboratory tests were simple, so far as volatilization was concerned, but recovery was a different matter. The process was finally worked in an experimental plant in Denver, and later a commercial plant was erected at Mayer, Ariz. The latter was never operated.

The stumbling block to success was the recovery of the volatilized chlorides. Bags, sprays, solution towers, etc., were tried at the recovery end, but without success. The problem was never satisfactorily solved. The volatilization feature, however, was attractive in regard to refractory ores, for they usually yielded to the treatment. Mr. Parmelee suggests that the one possible solution of the recovery problem is by the Cottrell method of fume condensation by means of a high-potential electric discharge. The volatilized metal chlorides might be suitably condensed by this process.

Barth Iron-Ore Deposit

An iron-ore deposit a few miles west of Palisade, in northern Nevada, was acquired and developed by the American Smelting & Refining Co., which, in six years, has shipped about 250,000 tons to its smelteries, near Salt Lake City. The deposit, now known as the West Iron mine, is described by J. Claude Jones in *Economic Geology*, April-May, 1913. The deposit is mined as an open pit for about 80 ft. down and by three levels, the upper of which is slightly below the bottom of the pit and the two others at 50-ft. intervals below the upper. The ore is a body about 100 ft. in thickness and 200 ft. long, dipping 40° to the northeast. It is a rather porous hematite body, containing minute apatite crystals; it runs high in iron, from 62 to 69%, and rather high in phosphorus, about 0.7% of P_2O_5. On the foot-wall, circulating waters have formed limonite. The body is a replacement in andesite, the replacement being remarkably complete. The minerals forming the orebody indicate that they were deposited under conditions of some heat and pressure, but from the lack of extensive metamorphism of the andesite it is evident that the ore-bearing solutions were not extremely hot. The best explanation capable of being given at present is that the solution came either as an after effect of the andesite flow or as a basic splitting of a magma which gave origin to a rhyolite capping on the andesite.

Determination of Titanium by Cupferron

The use of cupferron (the ammonium salt of nitrosophenlyhydroxylamine) as a reagent in the gravimetric determination of titanium is treated by J. Belluci and L. Grassi (*Atti. R. Accad. dei Lincei, Roma,* I, p. 30, 1913; abstr. *Journ.* Soc. Chem. Ind., p. 254, Mar. 15, 1913). A 6% solution of cupferron is added to the solution of titanium chloride or sulphate, which has been made distinctly acid with hydrochloric or sulphuric acid, until a white precipitate (of nitrosophenylhydroxylamine), easily distinguishable from the yellow precipitate of the titanium compound, begins to form. The precipitate is filtered off, washed with cold water, dried, and the paper and precipitate incinerated in a porcelain crucible, covered at first. The residual titanium dioxide is ignited till of constant weight. Preliminary experiments have shown that titanium can be accurately determined in presence of aluminum by means of cupferron.

High Falls for Water Power

At the Fullq hydro-electric installation—now under construction—in the Valais above Martigny, the column of water will attain a height of 5400 ft., says the *Mining Journal*, Apr. 26, 1913. This is the highest head of water yet utilized to drive an electric plant. The pipe line, nearly three miles long, will be composed of tubes having a diameter of 23½ and 19½ in., with a thickness of metal increasing from ¼ up to 1¾ in. The upper pipes will be welded and the lower ones drawn from blocks of solid steel. There will be four Pelton wheels of 3000 hp. each, provided with interchangeable paddles of forged steel. The issuing water will strike the paddles at a speed of 575 ft. per second.

The Corrosion of Aluminum

G. H. Bailey, in a paper on the "Corrosion of Aluminum," read recently before the Institute of Metals, gives a method by which reliable measurements of the rate of corrosion may be made, and draws the following conclusions:

That aluminum of high purity is less readily acted upon than that of lower purity, and that the presence of sodium and copper in the metal increases the rapidity of corrosion. Well annealed metal is also more resistant to corrosion than unannealed metal. He finds that, in general the corrosion of aluminum is a process of oxidation, and that metal exposed for several months to water or salt solutions from which the dissolved air has been expelled underwent no corrosion whatever. The normal course of corrosion (excluding the action of acids and alkalies) is thus a transformation of aluminum into alumina, which separates out as a flocculent precipitate without any of the aluminum passing into solution.

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22,347—LAMPS—Acetylene Lamps in Mines. R. Cremer. (Min. Journ., Mar. 29 and Apr. 5, 1913; 6½ pp., illus.) 60c.

22,348—LOCOMOTIVE—A Storage Battery Gathering Motor. (Coal Age, Mar. 15, 1913; 1¼ pp., illus.) 20c.

22,349—LOCOMOTIVES—Note sur la Traction par Locomotives a Benzine au Siege d'Havré des Charbonnages du Bois-du-Luc. Léon Hallez. (Pub. l'Assn. des Ing. de l'Ecole des Mines de Mons, Vol. V, 1911; 25 pp., illus.)

22,350—LOCOMOTIVES—Tests of Tunnel Compressed-Air Locomotives. (Comp. Air Mag., Apr., 1913; 1½ pp., illus.)

22,351—LOW-GRADE FUELS—The Economic Combustion of Low-Grade or Waste Fuels. David Moffat Myers. (Eng. Mag., May, 1913; 13½ pp., illus.) Second article of series, dealing with specific problems of furnace construction and operation adapted to various kinds of wood-working byproducts. 40c.

22,352—OIL ENGINE—Principles of the Diesel Oil Engine. Herbert Haas. (Eng. and Min. Journ., Apr. 26, 1913; 5¾ pp., illus.) 20c.

22,353—OIL ENGINES—The Principles of Fuel-Oil Engines. Hirschfeld. (Wisconsin Engr., May, 1913; 22 pp., illus.) 40c.

22,354—POWER PLANTS—Gas-Engine and Steam-Turbine Power Plants. W. C. Turner. (Power, Apr. 8, 1913; 2½ pp., illus.) Power-plant equipment in phosphate mining industry of Florida. 20c.

22,355—POWER SUPPLY on the Rand. A. E. Hadley. (South African Eng., Mar., 1913; 6⅞ pp., illus.; also Can. Engr., May 15, 1913.) Describes plant of Victoria Falls & Transvaal Power Co. and the Rand Mines Supply Co.

22,356—PRODUCER-GAS PLANT—Notes on a Bituminous-Producer Gas-Engine Plant. J. R. Cowell. (Journ. South African Inst. of Engrs., Feb., 1913; 7½ pp., illus.) Describes plant at Groenfontein Tin Mines, Transvaal. 60c.

22,357—PRODUCER-GAS PLANTS—The Commercial Trend of the Producer-Gas Power Plant in the United States. R. H. Fernald. (U. S. Bureau of Mines, Bull. 55, 1913; 92 pp., illus.)

22,358—PUMP Designed for Acid Water. (Coal Age, Apr. 5, 1913; 1¾ pp., illus.) 20c.

22,359—PUMP—The Evolution of the Mine Pump. Frank H. Kneeland. (Coal Age, Apr. 5, 1913; 1 p.) 20c.

22,360—PUMPS—Electric Motors for Driving Mine Pumps. W. H. Easton. (Coal Age, Apr. 5, 1913; 2½ pp., illus.) 20c.

22,361—PUMPS—The Advantages of Electric Pumps. J. W. Matthews. (Coal Age, Apr. 5, 1913; 2½ pp., illus.) 20c.

22,362—RESCUE APPARATUS—Der neue Westfalia-Rettungsapparat, Modell 1912. Breyhan. (Glückauf, Feb. 22, 1913; 4¾ pp., illus.) The new Westphalia rescue apparatus, pattern of 1912. 40c.

22,363—STEAM SHOVELS—Neuerungen im Bau von Löffelbaggern. Richter. (Zeit. des vereines Deutsch. Ing., Mar. 29, 1913; 5 pp., illus.) Improvements in the construction of steam shovels.

22,364—SURFACE-CONDENSING PLANT. A. Beeston. (Iron and Coal Tr. Rev., Feb. 28, 1913; 1½ pp., illus.) Paper before Nat. Assn. of Colliery Mgrs.; to be continued. 40c.

22,365—TRANSPORTATION—Installing a Mining Plant in Latin America. Edward W. Perry. (Eng. Mag., Feb., 1913; 11 pp., illus.) 40c.

SAMPLING AND ASSAYING

22,366—ATOMIC WEIGHTS—Twentieth Annual Report of the Committee on Atomic Weights. Determinations Published during 1912. F. W. Clarke. (Journ. Am. Chem. Soc., Mar., 1913; 8 pp.) 60c.

22,367—COAL ANALYSIS—Accuracy and Limitations of Coal Analysis. (Power, Mar. 11, 1913; 3 pp.) 20c.

22,368—COLUMBIUM—Ueber Niob- und Tantaltrennungen, speziell mittels Kaliumchlorids in fluszaurer Lösung. Meimberg and Winzer. (Zeit. f. angew. Chem., Mar. 14, 1913; 1½ pp.) On the methods for separating columbium from tantalum, especially by means of potassium chloride in hydrofluoric solution. 40c.

22,369—GAS ANALYSIS. A Modification of the Jäger Method of Gas Analysis. S. H. Worrell. (Met. and Chem. Eng., May, 1913; 2⅝ pp., illus.) 40c.

22,370—LIME—Standardization of Methods of Sampling and Determination of Available Alkalinity. (Pamphlet No. 3, Chemical Sub-Committee of So. African Eng. Standards Committee, Jan., 1913; 9 pp.)

22,371—MANGANESE—Ueber die massanlytische Manganbestimmung nach Volhard-Wolff. (Stahl u. Eisen, Apr. 17, 1913; 10 pp.) On the volumetric estimation of manganese by the Volhard-Wolff method. 40c.

22,372—RARE EARTHS—Some Quantitative Separations of Neodymium. T. O. Smith and C. James. (Journ. Am. Chem. Soc., May, 1913; 3 pp.) 60c.

22,372a—SAMPLING—Adequate Sampling in Modern Mill Practice. Donald F. Irvin. (Min. and Sci. Press, Apr. 5, 1913; 3½ pp., illus.) 20c.

22,373—SAMPLING—Notes on Mine Sampling. G. C. Bateman. (Bull. Can. Min. Inst., Mar., 1913; 11 pp.)

INDUSTRIAL CHEMISTRY

22,374—AMMONIA—Ammoniakdestillierapparate auf Teerkokereien. A. Thau. (Glückauf, Jan. 18 and 25, Feb. 1, 1913; 23¼ pp., illus.) Ammonia distilling apparatus at coking plants.

22,375—AMMONIA—Die Vorzüge des direkten Ammoniak-Gewinnungsverfahrens gegenüber des alten indirekten Verfahren. Heck. (Glückauf, Mar. 22, 1913; 5½ pp., illus.) Advantages of the direct ammonia recovery over the old indirect method. 40c.

22,376—AMMONIUM SULPHATE—Ueber die Gewinnung von Ammoniumsulphat mit Hilfe des in den Kokereigasen enthaltenen Schwefels. J. Reichel. (Glückauf, Apr. 12 and 19, 1913; 8 pp., illus.) On the recovery of ammonium sulphate by means of the sulphur contained in the coke gases. 60c.

22,377—BOILER-FEED WATER—Zur Kontrolle der Kesselspeisewasserreinigung. Weissberger. (Zeit. f. angew. Chem., Mar. 7, 1913; 2¾ pp.) Regarding the purification of boiler-feed water.

22,378—COKE BYPRODUCTS—Recovery of Byproducts in Coke Manufacture. W. E. Hartman. (Iron Tr. Rev., Apr. 3, 1913; 2¼ pp.) 20c.

22,379—INDUSTRIAL POISONING—The Prevention of Industrial Poisonings. C. E. A. Winslow. (Eighth Internat. Cong. of App. Chem., Vol. XXVI, 1912; 10 pp.)

22,380—LITHOPONE—L'Industrie du Lithopone. Ch. Coffignier. (Rev. Chim. Ind., Mar., 1913; 7¾ pp.)

22,381—PERCHLORIC ACID—Herstellung von Ueberchlorsäure. Mathers. (Chem. Ztg., Mar. 25, 1913; ¼ p.) Preparation of perchloric acid. 20c.

22,382—PIGMENTS—The Struggle Between White Pigments in Europe. Gaston de Pierres. (Eighth Internat. Cong. of App. Chem., Vol. XXV, 1912; 8 pp.)

22,383—SULPHURIC ACID—The New High Form of Sulphuric-Acid Chamber. F. J. Falding and W. R. Cathcart. (Journ. Ind. and Eng. Chem., Mar., 1913; 8 pp., illus.) 60c.

22,384—WOOD PRESERVATIVES—Tests to Determine the Commercial Value of Wood Preservatives. A Progress Report. Howard F. Weiss. (Journ. Ind. and Eng. Chem., May, 1913; 6½ pp., illus.) Paper presented at Eighth Internat. Congress of App. Chem., Sept., 1912. 60c.

MATERIALS OF CONSTRUCTION

22,385—PAINT as an Engineering Material. Maximilian Toch. (Journ. Ind. and Eng. Chem., May, 1913; 2½ pp., illus.) 60c.

22,386—PAINTS—The Behavior of Paints Under the Conditions of Practice with Special Reference to the Aspersions Cast Upon Lead Paints. Henry E. Armstrong and C. A. Klein. (Journ. Soc. Chem. Ind., Apr. 15, 1913; 11 pp., illus.)

22,386a—PORTLAND CEMENT—Control of Initial Setting Time of Portland Cement. E. E. Ware. (Journ. Ind. and Eng. Chem., May, 1913; 2¾ pp., illus.) 60c.

22,387—ROAD-BUILDING MATERIAL—A Classification of Road-Building Rocks. (Eng. and Contract., Mar. 26, 1913; 1¼ pp.) 20c.

22,388—TESTING OF MATERIALS—Die Tätigkeit des Kgl. Material prüfungsamtes im Betriebsjahre 1911. (Glückauf, Feb. 8, 1913; 2½ pp.) The work of the Royal Materials Testing Office in 1911. 40c.

22,389—TUFA CEMENT, as Manufactured and Used on the Los Angeles Aqueduct. (Proc. A. S. C. E., Jan. and Apr., 1913; 18 pp.) Discussion on paper previously indexed.

MISCELLANEOUS

22,390—ALASKA—The Settlement and Survey of the Alaskan Boundary. J. A. Flemer. (Eng. Mag., May, 1913; 17½ pp., illus.) 40c.

22,391—ENAMEL—The Function of the Various Raw Materials such as Quartz and Flint, Fluorspar, Calcite, Etc., in a Sheet Steel Enamel. Robert D. Landrum. (Eighth Internat. Cong. of App. Chem., Vol. XXV, 1912; 10 pp.)

22,392—FLOW OF STEAM in Pipes. A. E. Berggren. (Wisconsin Engr., Mar., 1913; 10 pp., illus.)

22,393—FLUME—Reconstruction of the American River Flume near Placerville, Calif. Lewis H. Eddy. (Eng. and Min. Journ., Mar. 29, 1913; 1½ pp., illus.) 20c.

22,394—HYDROELECTRIC POWER—The Generation and Transmission of Hydroelectric Power. E. A. Lof. (Eng. Mag. Feb., Mar., Apr. and May, 1913; 49 pp., illus.) $1.60.

22,395—MOTOR TRANSPORTATION as an Aid to Industrial Economy. Rollin W. Hutchinson, Jr. (Eng. Mag., Feb. and Mar., 1913; 33½ pp., illus. Gives comparative data of actual haulage costs. 80c.

22,396—MOTOR TRUCKS—Efficiency of Motor Trucks with Trailers. Morgan Cilley. (Eng. Rec., Feb. 1, 1913; 4⅜ pp., illus.) 20c.

22,397—POWER COSTS—Standardization of Method for Determining and Comparing Power Costs in Steam Plants. H. G. Stott and W. S. Gorsuch. (Proc. A. I. E. E., May, 1913; 33 pp., illus.)

22,398—POWER-PLANT ECONOMICS—II. Horace W. Flashman. (School of Mines Quart., Jan., 1913; 23 pp., illus.) 60c.

22,399—SCIENTIFIC MANAGEMENT in Isolated Plant Operation. Percival R. Moses. (Eng. Mag., Feb., 1913; 7 pp.) 40c.

22,400—SCIENTIFIC MANAGEMENT in Power-Plant Operation. Percival Robert Moses. (Eng. Mag., Mar., 1913; 9 pp., illus.) 40c.

22,401—STONE-CRUSHING Plant of Michigan Limestone & Chemical Co. (Elec. Rev., Apr. 26, 1913; 4½ pp., illus.) 20c.

22,402—STREAM-GAGING STATIONS as Component Parts of Water-Power and Other Hydraulic Works. John C. Hoyt. (Eng. News, Apr. 24, 1913; 1 p., illus.) 20c.

22,402a—SURVEYING—Stereo Photo Surveying. Henry Hess. (Proc. Engrs. Club of Phila., Apr., 1913; 19 pp., illus.)

22,403—TEMPERATURE CONVERSION TABLES. Leonard Waldo. (Bull. A. I. M. E., Apr., 1913; 5 pp.) 40c.

22,404—WATER MEASUREMENT—The V-Notch Weir Method of Measurement. D. Robert Yarnall. (Journ. A. S. M. E., Apr., 1913; 3 pp.)

22,405—WOOD PIPE—The Manufacture of Wood Pipe. E. F. Week. (Wisconsin Engr., Feb., 1913; 4 pp.)

22,406—YUKON COAL FIELDS, The. D. D. Cairnes. (Trans. Can. Min. Inst., 1912; 34 pp., illus.)

United States Smelting, Refining & Mining Co.

The report of the United States Smelting, Refining & Mining Co. for the year ended Dec. 31, 1912, shows net earnings, before providing for depreciation, of $5,497,965, and profits for the year of $4,232,965. These earnings were made on a metal production of 21,152,620 lb. of copper, 56,385,769 lb. of lead, 12,059,829 oz. of silver, and 140,183 oz. of gold. This includes the metals from custom ores and the Mexican production. During the year the Utah Co. was formed with a capital of $5,000,000, all owned by the United States Smelting, Refining & Mining Co., and the Utah Co. issued $10,000,000 of 6% five-year notes, guaranteed as to principal and interest by the smelting company. The proceeds of these notes are being used to take over the controlling interest in the Consolidated Fuel Co., the Black Horse Coal Co., the Castle Valley Coal Co., and other properties in this region, and to supply railroad facilities. In addition lands were acquired by a fourth company known as the Castle Gate Coal Co., of which the Smelting company owns all the stock. Reports of the various subsidiary companies are made as follows:

The Bingham mines, situated in Utah, produced 57,106 tons of lead ore, and 186,165 of copper ores, although the mines were shut down for part of September and October on account of a strike. The ore reserves were maintained unimpaired. At the Centennial-Eureka mine, also in Utah, development was continued on a large scale and considerable ore found, but the addition was not equal to the extraction, which amounted to 117,957 tons. Development work on the Bullion Beck & Champion Mining Co.'s property did not disclose anything of importance.

Extensive improvements and additions were made at the Midvale smeltery, Utah. A new roasting and sintering equipment was installed, which adds to the capacity of the smeltery and enables the treatment of an increased amount of sulphide ores. The smeltery, the concentrating mill, and the Huff electrostatic separating plant, all operated uninterruptedly through the year. The United States Lime Co.'s output amounted to 94,600 tons.

The extraction of ore from the Mammoth mine of the Mammoth Copper Mining Co., Calif., amounted to 278,088 tons. Ore developed during the year did not equal this amount, though some new territory recently opened up looks favorable for the development of orebodies. The smeltery operated with but one interruption throughout the year, due to the decay of the foundation under the baghouse fan, which closed down the work for a week. Experiments for the utilization of the baghouse products were carried on during the year but yielded no satisfactory results. If further experiments fail to find a more profitable process, then these products will be resmelted in the blast furnaces.

The siliceous ore situation is now satisfactory, although the Original Quartz Hill mine, which is held by the company under lease, furnished only 4300 tons during the year, and that was low-grade. There is only a small tonnage remaining in this mine.

The lead refinery at Grasselli, Ind., treated approximately the same tonnage as in 1911. Working conditions and costs were unchanged. Operations at the copper refinery and smeltery at Chrome show no material change from the previous year.

At the Gold Road Mines Co., Ariz., considerable work was done and 109,070 tons of ore were extracted and sent to the mill. Developments were satisfactory as regards quantity, but are said to have been disappointing as to quality. The mill was improved and enlarged and now handles 350 tons per day, as against 225 tons a year ago.

The Needles smeltery, in California, was run at intervals as during the preceding year. The supply of ore that was expected to come from the Tennessee mine did not materialize on account of the failure of the railroad company to complete a spur to the mine. The track is now completed and ore from the Tennessee mine is being shipped, and the mill has been started. At the Banner mine work was discontinued during the year when the small orebody was exhausted.

No work was done at the Richmond-Eureka mine, due to difficulties with the Eureka & Palisade R.R. This railroad, which was damaged by floods in 1910, and which since then has changed hands, was reopened for traffic during 1912. The new management published a freight rate largely in excess of the old tariff. Pending the adjustment of the rate to a reasonable basis, the Richmond-Eureka mines will remain closed.

The Real del Monte y Pachuca mines in Mexico were operated on a larger scale than ever before. The mill capacity is now 36,000 tons per month, and during the year 418,476 tons were treated. The cost of operation has been reduced, so that it is possible to treat profitably rock which was formerly unprofitable, and ore reserves at the end of the year were greatly in excess of those at the beginning. No difficulty was experienced on account of the political situation.

The Niagara Mining & Smelting Co. completed its reorganization during the year, but little work was done on the property. Work will be resumed on a larger scale in 1913.

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Zeolites and Silver

At the Southern Republic mine at Republic, Wash., a rather unusual replacement of gangue minerals is found in a certain vein. Within a narrow shoot, traceable over a vertical distance of 300 ft., says Waldemar Lindgren (*Trans.*, Can. Min. Inst.), the ordinary banded quartz filling had evidently been dissolved and a loose aggregate of calcite and laumontite was deposited in its place. Laumontite is one of the zeolites, and in this zeolitic zone the principal economic mineral was silver, whereas in other parts of the mine, where the quartz gangue was found, gold predominated. Although the ore would often assay as high as 50 oz. of silver per ton, few distinctly recognizable silver minerals could be seen. This occurrence suggests that the development of zeolites is probably favorable to a silver enrichment. Many facts from other kinds of veins, like those of Königsberg and Andreasberg, indicate that there is some sort of connection between zeolitization and deposition of silver.

❋

A Company for the Working of Madagascar Graphite has been formed under the laws of France ("La Tribune de Madagascar Dependances," Jan. 21, 1913; "Daily Consular and Trade Reports," Apr. 17, 1913). The shareholders are largely residents of England.

CORRESPONDENCE AND DISCUSSION

Consulting Engineers

I have read the letter by Carl E. Morris in the JOURNAL of May 24, 1913, with a fellow feeling, and wish to offer as an addition: "Happy the metallurgical plant that has no consulting engineer." In a case I remember, a consulting engineer was called in to design a sampling plant because "he had designed the Yellow-Jacket and the Hornet mills, and had had valuable experience."

The mere facts that the Yellow-Jacket mill couldn't sample low-grade paving stones with any accuracy and that the Hornet had been rebuilt by the men on the job cut no figure, the consultant got more money for a month's work on the new mill than those on the job did for a year's. The new mill cost more in repairs in two years that its original price, and was remodeled the third year. What's the answer?

W. W. B.

Denver, Colo., May, 30, 1913.

❖

Safety Gears for Hoisting Cages

A recent hoist accident in this country demonstrated a weak point of the ordinary safety catches for cages. The hoist was of the ordinary double-drum second-motion type, and the cages were fitted with the usual toothed safety pawls. The safety gear was reported to be in proper order and probably was. The hoist was old and not in good condition; among other defects one of the drums was cracked. It was not winding in balance.

The exact sequence of events is unknown, as the Mexican in charge was somewhat vague on the subject. It seems that while hoisting a carload of ore, which had nearly reached the surface, the defective drum commenced to break up. A large piece out of the rim, comprising a segment of the brake flange probably went first, the brake and also the friction-clutch failed to hold, and the load went to the bottom of the shaft, 1000 ft. deep. Pieces of the broken drum, friction-band and friction clutch were scattered some distance. The tail end of the rope with a piece of the drum attached went over the sheave and to the bottom.

The inertia of the rope running off the remains of the drum, combined with the inertia of the drum itself, probably checked the descent somewhat, and apparently was sufficient to hold off the safety pawls, which failed to engage. That the load was checked materially seems evident by the fact that only two guides at the bottom were torn out, and with this exception the timbering was undamaged. The cage and car were wrecked. Of course, the accident was unusual in character, but granted that for some reason the brakes should fail and the drum be out of control, it may well happen that inertia becomes too much for the springs to overcome and thus prevent the safety catches engaging, even if in good order.

A safety gear controlled by a centrifugal governor upon the cage, arranged to come into action upon a certain velocity being exceeded would be theoretically sound, but under ordinary mining conditions would be apt to be out of order at the critical moment. A slow-speed passenger elevator in this city was fitted with such a gear for many years, the governor being driven by a special fixed rope. In the case of a mine cage it might be more conveniently driven, perhaps, by friction rollers off the guides.

The above mentioned accident convinced me that much stronger springs than are customary should be fitted to the ordinary safety gear.

A. H. BROMLY.

Mexico, D. F., May 10, 1913.

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A Five-Ton Smelting Furnace that Smelts

In the JOURNAL of May 3, under the above caption, Clement H. Mace has apparently given to the members of the profession some startling figures. To those of us who have experienced difficulties in keeping a modern 150-ton blast furnace in good condition when running on a regular lead charge, under much less than 15% of good coke, or a copper charge containing only 8% sulphur, as Mr. Mace cites, under a figure much less than that for the lead charge, is certainly enough to make one "sit up and take notice." Since Mr. Mace's results are so unusual, I have thought fit to examine them a little more closely, so far as his data will allow, and see if perhaps, there has not been an oversight somewhere.

Beginning then, with the blast delivered, and assuming that the furnace is receiving the full volumetric displacement of the blower (as Mr. Mace assumes), and considering only the case of furnace run as a copper matting furnace, then the blower at 400 r.p.m., with 1.5 cu.ft. displacement, gives 600 cu.ft. of free air delivered to furnace per minute. Taking the weight of 1 cu.ft. of air as 0.078 lb., 600 cu.ft. will weigh 46.8 lb., and will contain 10.76 lb. of oxygen.

The furnace is credited with a capacity of 9 tons (18,000 lb.) of charge per 24 hr., equal to 12.5 lb. per min. We are told that this charge was smelted with only 5% of coke, and that it contained only 8% of sulphur. Assuming that the coke contained 85% of carbon, and that 75% of the sulphur on the charge was burned to SO_2, we have, figuring everything on the basis of one minute:

Charge smelted	12.5 lb.
Carbon consumed	0.531 lb.
Sulphur consumed (75% of 8%)	0.750 lb.

Assuming that all carbon is burned to CO_2, and 75% of the sulphur on the charge is burned to SO_2, we have:

Oxygen for carbon	1.416 lb.
Oxygen for sulphur	0.750 lb.
Total	2.166 lb.

The blower is delivering to the furnace 10.76 lb. of oxygen per min., and there is consumed in the oxidation of the carbon and sulphur only 2.166 lb., leaving 8.594 lb., which passes into the furnace gases and up the stack. In other words only 20.1% of the oxygen delivered to

the furnace is consumed. Of course, it will be objected that there are other constituents in the charge which are oxidized, but this can hardly be possible, since we are told there is only 8% of sulphur in the charge, and 75% of this has, according to our assumption, been oxidized, and the balance would be required for matte. We are not given the analysis of the ores constituting the charge, but with only 8% sulphur it is fair to assume that they consist mainly of oxides, and these would require reduction to render them suitable for slag forming purposes, thereby adding to the excess of oxygen. It would seem, therefore, that the "continuous aperture" proved to be an efficient substitute for the old-fashioned tuyere, but why it is necessary to force nearly five times as much air into the furnace as is required, is not clear.

Again, so far as the data given will allow, let us examine a little into the heat-balance sheet of the furnace. We have shown that there are 0.531 lb. of carbon oxidized to CO_2 per min., which would evolve 7721 B.t.u.; and 0.750 lb. of sulphur oxidized to SO_2 per min. evolving 2910 B.t.u., or a total heat evolution from carbon and sulphur of 10,630 B.t.u. per min. If we assume that the gas escaping from the top of the furnace is equal in weight to the blast delivered, and that this gas has a temperature of 1200° F., and a specific heat of 0.25 (a figure under rather than over the true amount), then the gas carries off 14,040 B.t.u. per min., or 3410 B.t.u. more than is evolved by the combustion of all the carbon and sulphur on the charge.

We are told that after "several hours' smelting the blast became so hot that it would scorch the skin." Under the conditions assumed thus far, let us see if it is possible to calculate about how hot the said blast would be. There is delivered to the furnace 46.80 lb. of air per min. at a temperature of, say, 60°, and 12.5 lb. of charge, of which we will say 70% will go to form slag, so there will be 8.75 lb. of slag formed per minute at a temperature of, say, 1500° F., having a specific heat of 0.27, then this quantity of slag would contain 3544 B.t.u., and if all this heat could be absorbed by the 46.8 lb. of air, the blast would have a temperature of 363° F., and if only half the total heat contained in the slag was absorbed by the blast, it would have a temperature of 211° Fahrenheit.

Since, however, all the heat available in the furnace is derived primarily from the combustion of the carbon and sulphur on the charge, and the total heat so derived has been shown to be only 10,630 B.t.u., 3410 B.t.u. less than enough to heat the waste gases, we are still short the necessary heat units to effect the chemical reactions in the furnace, and heat the products (slag and matte) to the final temperatures, as well as to supply all the heat carried off in jacket water and otherwise lost.

Admitting that the field for such a smelting furnace as described would probably be a large one, there would appear to be some question as to its feasibility. A furnace operated on the lines of the Partridge would enable the small producer to purchase and operate his own smeltery, and with capacities so small, and such a simple and inexpensive plant, it could easily be moved around wherever the exigencies might require. Whenever the ore supply at one mine got a little slack, the whole plant could be bundled off to another mine, where a supply of ore was available, while development and exploratory work was progressing at the first site, if this was thought promising, somewhat like these little sawmills that you see scattered all over our part of the country. I would judge, too, that the services of a high-priced metallurgist to direct affairs would not be necessary. Such information as the miner had been able to acquire during his leisure moments about the smelting business would be quite sufficient to conduct the plant successfully. Moreover, every miner his own smelter would make him entirely independent of any wicked smelter trust. In fact, it would only be a few years until they would be compelled to go out of business, or else adopt the methods of the miner-smelters.

However, without calling in question the figures of the JOURNAL correspondent, that the revolutions of the blower were accurately counted (at least I have assumed that they were), and that the ore, fuel and flux, together wtih the products of the furnace, were duly weighed and credited, still there is a suspicion that somebody, possibly some visitor, was unprincipled enough to heave in a few shovels of coke when no one was looking.

ROYAL P. JARVIS.

Knoxville, Tenn., May 22, 1913.

❖

Association of Topaz and Stream Tin

In the JOURNAL of Mar. 8, 1913, p. 511, is an article on topaz and stream tin in Mason County, Texas, by H. Conrad Meyer. In it he refers to the intimate associations of topaz with quartz and feldspar as a rock mass in pegmatite and makes a passing reference to the occurrence and significance of topaz close to the orebodies at Mt. Bischoff in Tasmania.

It may be useful and interesting to add further support to Mr. Meyer's inference by giving some particulars of a topaz-ore rock which occurs at Torrington, N. S. W., containing wolfram. This rock appears to be a product of the final phase of intrusion of the granites which have thrust up and through the overlying sediments of Permo-Carboniferous age. It is essentially a quartz-topaz rock with more or less feldspar (orthoclase). Where the replacement of the feldspar is practically complete, a quartz-topaz rock or a quartz-mica-topaz rock remains, which may be regarded as a congener of the greisens found in other parts of this extensive tin field. The contact sediments show considerable metasomatic alteration. Fine crystals of gem topaz, beryl, emerald and sapphire are found in the alluvials of the field.

CHARLES A. MULHOLLAND.

Sydney, N. S. W., Apr. 1, 1913.

❖

The Uranium and Radium Situation

The article in the JOURNAL of May 31, 1913, on the uranium and radium situation, states that carnotite is purchased wholly on "the radium content, comparatively little being allowed for the vanadium present."

A large part of the Colorado and Utah carnotite marketed has been sold for export on our analyses, and while it is true that comparatively little has been paid for the vanadium contents of these ores, the basis of settlement is the uranium content, or rather its uranium oxide (U_3O_8) equivalent, and not on the radium content. The radium is, of course, proportional to the uranium, but the percentage of uranium oxide always serves as the basis of settlement.

New York, June 2, 1913. LEDOUX & Co.

EDITORIALS

Mine Taxation in Arizona

According to the new law recently enacted in Arizona, the mines of that state are to be valued at four times their annual net profit, plus one-eighth the gross profit, plus the value of their improvements. This will raise the valuation of the mines of the state from $45,000,000 in 1912 to $125,000,000. This is a heavy increase, but the mine owners had to agree to it as the best that could be obtained under the present conditions in Arizona.

There has no doubt been a good deal of tax dodging on the part of some of the mining companies in the past. This led naturally to a wave of dissatisfaction, which has carried the assessment higher than probably it really should be. However, the law recently enacted runs for only two years, and after all, its bearing will depend upon the assessment of the rest of the state.

In 1912 the mines of Arizona were assessed at $45,000,000, the remainder of the property in the state, including the ranch land and cattle, going in at $95,000,000, or a total of $140,000,000. It is estimated that this year the producing and nonproducing mines will be put in at $125,000,000, and the remainder of the property in the state at $200,000,000, but the latter valuation may be only $175,000,000. Assuming the latter figure, the total valuation of the state will be about $300,000,000, making the mines pay about 42% of the taxes. In 1912 they paid 31.7%.

The Development of the Cyanide Process

It is not many years ago that cyanidation was believed to be economically limited to use with but a small number of minerals. In its beginning, those ores containing finely-divided free gold were thought to be the only ones amenable to the process, but it was not long before it was extended to more refractory gold minerals and to silver ores, which latter were for a long time believed to be entirely outside the influence of cyanidation, even by those highly skilled in the treatment of gold ores. Advancing from the treatment of simple minerals, cyanidation is being applied to extremely complex ores, an example being the practice at Cobalt, where special methods are being developed to meet special needs.

There are, however, other steps to be taken in order to widen the field of cyanidation. A particularly important application is that of gold or silver minerals which contain small quantities of copper or zinc or lead, or all of them; not in sufficient quantity to be valuable for their own sake, but in total materially increasing the value of the production if they could be recovered by an inexpensive process along with the gold and silver. Some steps have already been taken toward the solving of this problem in the work of D. Mosher and Bertram Hunt, but they have not yet been practically applied in a large way. It seems certain, however, that this development must be perfected some day, and it will materially increase the value of the production won by cyanidation and make valuable many minerals which are now worthless by reason of their complexity.

Metallurgical Laboratories

One of the reasons for the growth and strength of the great metallurgical companies of the United States is their ability to develop new processes and go into new things. This has been emphasized especially since they have recognized the possibilities of a research department. We recollect an engineer advising a client, a metallurgical company, some 10 or 15 years ago to appropriate $25,000 annually for investigations. "Specifically what do you propose to do with the money?" asked the directors. "Nothing specifically, so far as I can say now," was the reply. "I have it in mind just to explore among subjects connected with our work." The directors politely refrained from calling him a lunatic, although they were evidently unanimously of that opinion. However, that same company is today running a research department in just about the way that was recommended to it then. Indeed, nearly all of the big metallurgical companies now do it.

These companies have not only the advantage of ample funds for researches, but also those of organized staffs and facilities for carrying on work. A new process is proposed. It is an easy matter to try it out in a corner of the plant, with power, water, steam, means for crushing, roasting, etc., all at hand. The individual encounters difficulty even in finding a place, is likely to have to put up with unsatisfactory makeshifts, and is generally short of funds and shrieking for help all the time. A basic-bessemer process may be developed in a cellar by the genius of a Sydney Gilchrist Thomas, but even to the inventor is such patience and persistence, such indomitable surmounting of all obstacles, seldom given.

It is a pity, we think, that facilities are not here and there afforded to independent inventors, or even to engineers who are desirous of testing new ideas or proposals. There are, indeed, some testing works, so called, in New York, St. Louis, Denver and Salt Lake City, and perhaps elsewhere, but no one of them quite fills the bill. We have never heard that any of their proprietors have become rich through their operation and we fancy this teaches that after all there is not a sufficient demand for an ideal plant of this sort to induce the provision of it on purely commercial grounds.

There remain the laboratories of the mining schools, many of which are elaborate affairs. Unfortunately they serve but little useful purpose outside of the education of students. That is, of course, their main purpose and we ought not perhaps to find fault with them for not filling any other purpose. However, it is doubtful whether they fill their educational purpose to best advantage and certainly they might be of broader use.

The common mining-school laboratory is a conventional affair. There are means of putting ores through a variety of the processes of the art, or something like them, but we question whether this is of much good to the student, who is destined later on to see the real thing and do it in the real way. The student obtains some practice in accounting for metallurgical products and in figuring up results, in other words he is put to thinking in the right way; but might not that be accomplished by turning him to some original work in the school laboratory?

We are not attempting to argue that the students of a mining school ought to be converted into researchers, but merely are we indicating that their attention might advisably be directed that way and the laboratories might advantageously be designed to permit of it. If such laboratories were thrown open to engineers for purposes of special investigations it would be to the benefit of them, of the schools, of the students, in short of everybody.

The trouble with the rank and file of metallurgical laboratories is that they are too cramped and are so situated that the discharge of noxious gases and the committing of other nuisances may not be allowed. Our notion of an ideal laboratory, discarding conventional ideas, is something like a public automobile garage: A spacious, one-story building with a solid concrete floor and lines of air, steam and water pipes and electric wires running down each side. In one part there ought to be some machine tools and in other parts some standard machinery for crushing ores, etc., some means for roasting, and the performance of other common processes. The chief area of the floor ought to be left clear for the installation of special plant according to requirements. The several units, representing steps of the process to be tested, ought to be capable of shuffling around and grouping to suit, just as a mill-draftsman does with his templates. After completion of its special purpose a plant would be left standing or would be dismantled according to wish.

We have an idea that it is the desire for some facilities of this kind, the need that is felt but is poorly expressed, that is manifested in the demands that have come from Colorado and Utah that the Bureau of Mines be given a Congressional appropriation for the establishment of testing plants. The Mines Branch of the Canadian department of mines, under the enlightened administration of Doctor Haanel, has lately been installing at Ottawa a laboratory for just the purposes that we have outlined in this article, and it will undoubtedly be of great use to the mining and metallurgical engineers of the Dominion, who will be able to find its facilities for conducting the testing work that often falls to them to do.

The Stocks of Copper

The constant reduction in the stock of copper in Europe, while exports to there from America continue at a phenomenally high rate is difficult of explanation. We know that consumption is still going on in Europe at a high rate, but the extent indicated by the statistics rather exceeds imagination, exceeding it even after the probable diminution in extra-American production is taken into account. The explanation, of course, may be that some of the copper that has been going to Europe has passed into private warehouse, where it is no longer statistically reported. The weakness of the market in the face of a strong statistical position is in a way confirmatory of this idea. It is also probable that manufacturers who allowed their stocks to run low in the early part of this year have been replenishing the supplies that they normally carry in their yards. Whatever be the situation in these respects, it appears certain that nobody is now lugging such loads of copper as they begun to in 1907, and had to continue with for several years thereafter.

American Manufacturers in World Competition

A short description of an extremely powerful mine hoist, sold by the Nordberg Manufacturing Co., to a Canadian concern, appearing in this issue of the JOURNAL, is chiefly of interest, not for the record size of the engine, but for the sidelight it throws on the working of tariff laws. The periodical wail of our protected manufacturers now mounting in a full chorus, brings a feeling of shame to a good many Americans. We cannot believe that American interests, as a whole, need the intervention of a protective tariff to meet foreign competition. If the threatened tariff reductions do nothing else, they will perform a real service in waking up the manufacturing industries, cleaning out the dry rot, tuning up the organizations, and putting America on her mettle in open competition with the world. This sale of a large hoist in a foreign country in spite of the handicap of a preferential duty favoring England, shows what may be expected. There is no tariff that can control the sale of real ability.

Closing the Freiberg Mines

Glückauf reports that the mines of Freiberg, Saxony, will be closed at the end of September this year, but probably one mine will be kept open for the purposes of the *Bergakademie* and the *Bergschule*. The Freiberg mines were first opened in 1168 and in the next century they were actively exploited. In 1572 they made their maximum production. In 1791 they supported a population of 5187 souls. In 1878 there were 38 mines in operation, employing a technical staff of 250 men and about 6000 miners and laborers. The fall in silver in 1893 affected these mines severely and since then their production has been steadily dwindling. From beginning to end they have yielded over five million kilograms of silver. Many American engineers, who obtained their education at Freiberg, will hear with sorrow of the final closing of its famous old mines.

The government seems to have abandoned one of its leading points in the suit against the anthracite companies. It is announced from Washington that the contracts under which independent coal companies sell their coal to the carriers will be allowed, provided no pressure is put upon the sellers to compel them to make contracts. The contracts are legalized, but the independents are not obliged to accept them if they can sell their coal any other way.

BY THE WAY

In speaking of some recent electrolytic research, Dr. Edward Weston said that there was much less hydrogen occluded in a nickel deposit from a chloride-borate solution than from a sulphate solution. When such a deposit was electrically heated *in vacuo,* which even then caused the evolution of considerable hydrogen, the resulting nickel was found to be but little harder than copper.

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The total production of silver from Cobalt will be 206,400,000 oz., according to G. R. Mickle (*Trans.* Can. Min. Inst.). This figure is obtained by dividing the known veins into groups, ascertaining the production of each to date, and the probable percentage of the total content so far obtained, and making allowances for possible undiscovered veins. It is maintained that this estimation should be correct within 10% either way.

⁂

The Standard Oil Co. had a singular strike at its Canton, Md., plant, recently. It involved about 30 men, who were employed as still cleaners and who demanded an increase in wages from 23 to 25c. per hr. They based their demand largely upon the apparent fact that the fumes around the stills cause their hair to turn red in a short time, no matter what the color of their cranial covering may have been originally.

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It seems that our mining schools should inaugurate a course in trance mediumship, or establish some method of teaching second sight to the embryo mining engineer. This, in view of the story that "a woman's thrice repeated dream" (note the mystic three) led to the discovery of silver in "such rock as no trained mining man would have considered seriously," and located with most astonishing accuracy the original discovery in the new fields at Eagle, Colorado.

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The Broken Hill Proprietary Co., in New South Wales, has progressed so far with its plans for extensive iron works that contracts have been placed here for material for a blast furnace and rolling mills. No contracts for the steeel works have yet been let. The contract for the blast furnace was placed with the William B. Pollock Co., Youngstown, Ohio, and the Mesta Machine Co., Pittsburgh, received an order for three high-speed blowing engines. These will be exact duplicates of several recently furnished to the Shenango Furnace Co., at Sharpsville, Penn. They will have 44-in. steam cylinders, 84-in. drawheads, 50-in. stroke and are built for a maximum pressure of 30 lb. and a maximum speed of 80 r.p.m.

⁂

The report for 1912, just issued by the Aluminum Industrie Gesellschaft, which owns the great works at Neuhausen, in Switzerland, shows net profits for the year of $717,000, against $448,000 in 1911; an increase of $269,000. Dividends were 20%, against 14% in 1911. The report states that the exceptionally low prices which prevailed for some time resulted in many new uses being found for the metal, which favorably influenced the development of the industry, and enabled the entire production to go into consumption. A new agreement has since been entered into by the various aluminum makers. The subsidiary industries carried on by the Neuhausen concern, the manufacture of carbide and nitric acid, have quite justified expectations, and extensions are being carried out in various directions. The present capital is $2,500,000 and there are loans to the amount of $2,070,000.

⁂

Mr. Farrell, of the Steel Corporation, obviously studied political economy in a different school than Judge Gary. Taking up the question of prices in the steel trade Mr. Farrell said that they were governed solely by market conditions. "The price is generally determined by the amount of tonnage in the market," he explained. "You have to go out and find your market price. We get our knowledge of prices mainly from trade papers, who seek and give information both for buyer and seller." Mr. Farrell said that the corporation published price lists which were sometimes adhered to for considerable periods. He cited the fact that bars had been selling at 1.4c per lb. since last July.

"Does that indicate that competitive conditions do not exist?" "Only in the minds of theorists and economists," replied the witness. "There has been competition, but the demand has somewhat exceeded the supply, so the price has remained on the same basis." In that time, Mr. Farrell added, trade papers had reported that competitors of the corporation had been asking premiums for prompt delivery. "Not within my knowledge has the Steel Corporation ever charged premiums for prompt delivery," said the witness, emphatically.

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"I have endeavored to discover as to how and when the ratio of value between gold and silver commenced, and as to what was its origin," said Bedford McNeill, in his presidential address before the Institution of Mining and Metallurgy. "Sir David Barbour has called my attention to an interesting theory of Professor D'Arcy Thompson, 'that the origin of the ratio may have been astronomical, gold being associated with the sun, and silver with the moon; the period of the earth's revolution round the sun being 365¼ days, and that of the moon round the earth 27.32 days, it will be found that the ratio between these figures is very nearly 13⅓, and this figure 13⅓ was the ratio that was fixed between gold and silver during the Babylonian Empire (2000 B.C.) down to the Lydian Empire (500 B.C.).' Professor D'Arcy Thompson has also pointed out that the Lydians made coins of what was called 'electrum,' and reckoned one electrum coin as being of the same value as 10 silver coins of the same weight. It was supposed that the Lydians were unable to separate the gold from the silver, but when we find by assay that the proportions in these old coins of gold to silver were approximately as 73 and 27, and calculating gold as 13⅓ times as valuable as silver, and we find that an electrum coin would be worth exactly 10 silver coins of the same weight, we cannot help but admit that the Lydian assayers must have been well versed in the science and practice of their art, and that such figures cannot be mere coincidences."

May Mining Dividends

May dividends paid by United States mining companies amounted to $1,964,318, paid by 29 companies. Iron-smelting and industrial companies allied with the mining industry paid $9,897,180, and Mexican and Canadian mining companies paid $1,188,841. These figures, although still good, mark a recession from the high levels of the last few months, a condition which also marked the May dividends of a year ago. For the first five months of the year, United States mining companies making public reports have paid $30,884,487; iron-smelting, industrial and holding companies have paid $41,693,588; and Canadian, Mexican and Central American companies, $9,494,122.

United States Mining Companies	Situation	Per Share	Total
Alaska Mexican, g	Alas.	$0.30	$54,000
Alaska Treadwell, g	Alas.	1.00	200,000
Alaska United, g	Alas.	0.60	108,120
Arizona, pfd., B., c	Ariz.	.....	53,842
Bunker Hill & Sullivan, l.s	Idaho	0.02	65,400
Bunker Hill Con. g	Calif.	0.05	10,000
Champion, c	Mich.	1.00	100,000
Elkton Con., g	Colo.	0.02	50,000
Fremont, g	Calif.	0.02	4,000
Frontier, z	Wis.	2.00	2,500
Gemini-Keystone, l.g.s	Utah	10.00	50,000
Gold Chain, g	Utah	0.03	30,000
Golden Cycle, g	Colo.	0.02	30,000
Hecla, l.s	Idaho	0.02	20,000
Homestake, g	S. D.	0.65	163,254
Miami, c	Ariz.	0.50	372,202
Nevada Wonder, s	Nev.	0.10	140,000
Parrot, c	Mont.	0.15	34,477
Stratton's Independence, g	Colo.	0.06	60.750
Success, z	Ida.	0.01	15,000
Tom Reed, g	Ariz.	0.06	54,373
Tuolumne, c	Mont.	0.10	80,000
United, c	Wash.	0.01	10,000
United Verde, c	Ariz.	0.75	225,000
Wasp No. 2, g	S. D.	0.02	10,000
Yellow Pine, l.z.s	Nev.	0.02	19,000
Yosemite Dredging, g	Calif.	0.10	2,400
Iron, Industrial and Holding Companies	**Situation**	**Per Share**	**Total**
Amalgamated, c	Mont.	$1.50	$2,308,319
Cambria Steel	Penn.	0.62½	562,500
International Nickel, pfd	N.J., Ont.	1.50	133,689
International Sm. & Ref	U. S.	2.00	200,000
National Carbon, pfd	U. S.	1.75	78,785
Pennsylvania Steel, pfd	Penn.	1.50	249,500
United States Steel, pfd	U. S.	1.75	6,304,919
Warwick Iron & Steel	Penn.	0.40	59,468
Canadian, Mexican and Central American Companies	**Situation**	**Per Share**	**Total**
Alacran, g.s	Mex.	$2.00	$19,200
Amparo, g.s	Mex.	0.04	80,000
Angustias, Dolores y Anexas, g.s	Mex.	1.50	1,500
Buffalo, s	Ont.	0.03	30,000
Chontalpan, s	Mex.	0.50	3,000
Cobalt Lake, s	Ont.	0.03	112,650
Coniagas, s	Ont.	0.09	360,000
Crown Reserve, s	Ont.	0.05	88,441
Cobalt Townsite, s	Ont.	....	120,000
Hollinger, g	Ont.	0.15	90,000
Lucky Tiger, g	Mex.	0.05	35,767
San Toy, g.s	Mex.	0.01	60,000
Standard, s.l	B. C.	0.02½	50,000
Steel Co. of Canada, pfd	Canada	1.75	113,750
Temisk. & Hud. Bay	Ont.	3.00	23,283
Victoria, l.s.g	Mex.	0.50	1,250

Chronology of Mining for May, 1913

May 2—Protesting against the employment of non-unionist workmen, 50,000 coal miners in Wales went out on strike, carrying out the threat made one month previous.

May 3—Two men killed by fall of ground in Liberty Bell mine, Telluride, Colo.

May 5—Strike of coal miners in Wales settled.—Coal miners on strike at Nanaimo, B. C., vote to return to work.

May 8—Two men killed by fall of rock in the Idaho-Maryland mine, at Grass Valley, Calif.

May 10—First carload of ore shipped from the recently discovered silver camp of Eagle, Colo.—The strike of 60,000 coal miners in the district of Beuthen, Germany, which began Apr. 21, called off by the union.

May 14—Arizona mine-tax bill passed.

May 17—Fifteen men killed by explosion of gas in the Imperial mine of the Gates Coal Co., at Belle Valley, Ohio.

May 21—Federal investigation of conditions in the coal regions of West Virginia authorized by the Senate.

May 20—Citizens of Denver, Colo., voted for amendment of charter to permit the city to issue bonds for the Moffat tunnel project.

May 25—Mines at Cobalt voted against a strike.

May 28—Strikers at the iron mines of the Empire Steel & Iron Co., near Wharton, N. J., returned to work, having been out since Mar. 24; they failed to secure recognition of the union.

Concentration of Pitchblende

By Henry E. Wood*

Among the so called rare elements radium probably attracts the greatest attention, due to the wonderful properties attributed to it, and also to its great commercial value. The known deposits are limited, but prominent among them is a group of pitchblende veins in Gilpin County, Colo., near Central City, where Dr. Richard Pearce was the first to call attention to it. Within the last few years its presence and value have been recognized, and at the present time a small constant production is maintained.

It is found in pockets of varying size, occasional masses of 50 lb. or more having been found. The largest one known to me weighs over 800 lb., and is at present simply kept as a mineral specimen in Denver. As such lenses of this valuable ore might be passed by in ordinary mining operations, due partly to irregularities in the vein formation, I suggested two years ago that properly arranged photographic plates might be used to detect their proximity, although out of sight.

The ore is recovered by hand sorting, it being easily recognizable by its heavy weight (specific gravity 9 to 9.7) and its color which resembles pitch. It is interesting to note that the first determination of the presence of nitrogen in the original crust of the earth was in this rock in an analysis by Hillebrand. In the treatment of pitchblende by the Austrian Radium Institute, it may be noted that it takes 10 tons of ore to yield approximately 1 gram of radium bromide. To obtain this, there are 5½ tons of chemicals and 55 tons of water used, and there are over a thousand crystallizations made, each requiring from a few hours to several days.

The concentration of these ores is complicated, as gold, silver, lead, copper, zinc and iron are frequently present, particularly the latter, as iron pyrite. Hitherto it has been the custom to remove only the silica in the preliminary concentration, but such practice is the cause of a large loss of the uranium oxide.

Some of the minerals mentioned are present in such large quantities that they vastly exceed the proportions by weight of the pitchblende being sought. While it has a high specific gravity, it is either hopelessly entangled with the large volume of iron sulphides present, or else it is lost on account of its fineness. It is probably due to its characteristic and extreme brittleness, although it has a hardness above 5, that a large percentage of it is

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shattered into an extremely fine state of division by the forces necessary to detach it from the gangue and other minerals present. We have had frequent experience and collected many data from other commercial tests that have been made, all of which have clearly demonstrated that a preliminary reduction in bulk by concentration invariably results in a loss of nearly 50%. A fineness of 20 mesh will free most of the pitchblende from the gangue and other minerals. About one-half of the pitchblende will retain its crystallized shape at this size and is recoverable in quite high-grade products, but rarely accounts for over 50% of the mineral present.

However, we have found that the following plan will usually result in a 90% recovery of the pitchblende in a concentrate assaying from 45 to 56% of U_3O_8, but as a 30% grade is salable it is not necessary to run the risk of a low recovery to obtain so high-grade a product. The plan adopted consists of the following steps: (1) Crushing at 20 mesh; (2) roasting to expel sulphur, thereby converting the FeS_2 to the magnetic Fe_3O_4; (3) magnetic removal of the iron; (4) gravity (either wet or dry) separation of the U_3O_8 from the nonmagnetic portion.

On carnotite ores we have found that the removal of vanadium oxide is possible by the simple line of agitation of 20-mesh ore in water, followed by the collection of the slime as a concentrate. A 1 to 2% $V_2O_3 + U_3O_8$ ore can by this plan be concentrated several times into one with a recovery of 75 to 85%. The ore itself, after removal of the vanadium and uranium oxide, is a source of radium.

Goldfield Consolidated

The report of the Goldfield Consolidated Mines Co. and the Goldfield Consolidated Milling & Transportation Co., of Nevada, for April, 1913, shows a total production of 26,185 tons of ore, from which was realized $193,355, of which the mining realization was $28,297, and the milling and transportation company's profits and miscellaneous earnings were $165,058.

Of development work, 3700 ft. were performed during the month. The combined operating costs of the two companies were as follows: Mining, including stoping and development, $3.79; transportation, 10c.; milling, $2.04; marketing, 6c.; general expenses, 31c.; bullion tax, 3c.; construction, 7c.; marketing ore shipped, 67c.; total, $7.07. Miscellaneous earnings deducted, 15c.; leaving a total net cost of $6.92. A change was made in the filter plant at the mill, necessitating the running of 80 instead of 100 stamps while the change was in progress. Work is now completed.

Calumet & Hecla Holdings

It appears, from its annual report, that the Calumet & Hecla company has altered some of its stock holdings from the figures reported last year (cf. ENG. AND MIN. JOURN., Aug. 17, 1912, p. 320, for complete list). The sales were: Ahmeek, 600 shares; Centennial, 2000 shares. The purchases were: Allouez, 2000; Isle Royale, 3000; Laurium, 4050; White Pine, 3300. All the remaining outstanding stock of Dana, Frontenac, Manitou, and St. Louis was picked up, and actual physical control of the properties taken over.

Public-Land Legislation

WASHINGTON CORRESPONDENCE

Representative Lafferty has introduced a bill, relating to entries on the public lands, in the House of Representatives, which seems likely to receive some attention. In this bill Mr. Lafferty provides:

Be it enacted: That it shall be unlawful for any officer of the United States to consider or use in connection with any order, finding, or decision to be entered, made or rendered in any case relating to the rights of any person to enter or perfect title to any land entered under the public-land laws, any report, letter, or other information submitted in writing, directly or indirectly, without first submitting to the person whose rights are affected a true and literal copy of said information, and affording that person proper opportunity to disprove any charge so made injuriously affecting his or her rights, and at said hearing issues shall be joined upon the charge or charges made and evidence shall be confined strictly to the matter in issue.

In the last section of the bill the question of proof with regard to land is dealt with and it is provided: "That upon the submission of final proof upon any lands entered, it shall be the duty of the Commissioner of the General Land Office to consider and determine the sufficiency of said proof within one year from the submission thereof, and upon his failure to so do the entryman may they apply to the United States court, and upon the submission by the entryman of satisfactory evidence of his compliance with all the requirements of the law, the judge thereof shall enter a decree, adjudging the entryman entitled to a patent to the land applied for from the United States, which decree, unless appealed from, shall become final within 60 days from the entering thereof, and upon certification thereof to the Secretary of the Interior shall be by him carried into effect."

Coal-Mine Accidents in the United States

According to the figures compiled by Frederick W. Horton, of the Bureau of Mines, 213 men were killed in and about the coal mines of the United States in January, and 197 in February, 1913, a total of 410 in the first two months of the year. This statement does not include fatalities in Kentucky, Georgia, California and Oregon. Excluding these four states, a total of 450 men were killed in January and February, 1912, where 410 men were killed during the first two months of this year. The record for January and February, 1913, gives rise to the hope that the fatality rate for the current year may be even lower than that for 1912, when the death rate per million tons of coal mined (4.29) was the lowest ever recorded for this country, and the death rate per thousand men employed (3.15) was the lowest since 1899. The statistics show that about 50% of the fatalities in the first two months of 1913, were the result of falls of roof.

The Development of 300,000 hp. from the Dalles of the Columbia, is recommended in "Bulletin" No. 3 of the State Engineer's Office, Salem, Ore. The site is said to offer unusual opportunities for cheap hydro-electric power. It is stated that one fertilizer company is considering purchasing 240,000 hp. at $9 per horsepower-year. The plant, as outlined, would be situated at Big Eddy, three miles above the Dalles and about 90 miles from Portland. The plant would comprise 21 turbines operating under a head varying from 42 ft. at high water to 73 ft. at low water. The minimum flow is 50,000 sec.-ft.; the maximum, 1,390,000 and the mean, 235,000. It is estimated that the installation would cost something more than $23,000,000, or $77 per horsepower, which would give a cost for low-tension power at the station of $6.90 per horsepower-year.

PERSONALS

Rensselaer Toll, of Denver, Colo., is in La Plata Mountains on professional work.

Professor S. B. Christy, of the University of California, is in New York this week.

Frank H. Probert is visiting the Patagonia district, Arizona, for a few days on professional work.

Arthur H. Osborne has been appointed general manager of the Onondago Mines Co. at Georgetown, Colorado.

H. R. Drullard has been appointed superintendent of the Hardenberg mine in California, succeeding Mr. Bryant, resigned.

Corey C. Brayton sailed from Seattle on June 2 for Nome, Alaska. He expects to remain there until the last boat leaves in the fall.

Howland Bancroft will spend the next two or three weeks in Washington, New York and Boston, returning to Denver some time in June.

E. Norris Hobart is now engineer of the Mina Tiro General of the American Smelting & Refining Co., at Charcas, San Luis Potosi, Mexico.

C. W. Purington has severed his connection with the Pioneer Co. of Siberia, Ltd. Mr. Purington left London on May 31 for the Olekma District of Siberia.

Todd Kennedy, engineer of the Pettit mine of the Republic Iron & Steel Co., Gilbert, Minn., has been transferred to the company's mines at Negaunee, Michigan.

Burr A. Robinson, for some time past on the staff of the "Engineering & Mining Journal," has been appointed assistant to the secretary of the American Institute of Mining Engineers.

C. Vey Holman, of South Thomaston, Me., has been appointed official representative of the State of Maine at the International Geological Congress at Toronto in August next.

Lester S. Grant, formerly superintendent of the Isabella Mines Co., of Cripple Creek, is now superintendent of the Jumper Californian Mines Co., at Stent, Tuolumne County, California.

Fred M. Prescott, of Milwaukee, the well known builder of mine pumps, has resigned as president of the Fred M. Prescott Steam Pump Co., to attend to other business in which he is interested.

Samuel B. Sheldon, formerly connected with the Lackawanna Steel Co. and afterward with the Bethlehem Steel Co., has been appointed general superintendent of the Minnesota Steel Co., Duluth.

Herman L. Schneider, late consulting engineer for the Boston Superior Mining & Smelting Co., has opened an office at El Paso, Texas, Room 511, Mills Building, and will engage in a general mining business.

M. Hauber, Jr., has resigned his position with the Cia. de Minerales y Metales, S. A., of Mexico City, and has opened a custom assay office and chemical laboratory at 305 North Stanton Street, El Paso, Texas.

Thomas Cameron has been appointed superintendent of the new mill of the Calaveras Copper Co., at Copperopolis, Calif. He was recently with the Bunker Hill & Sullivan Mining Co. in the Cœur d'Alene district, Idaho.

George E. Farish has resigned his position as general manager of the Motherlode Sheep Creek Mining Company, of Sheep Creek, B. C., and, after an examination in Colorado, will return to New York about the middle of June.

Charles V. Lawder, formerly with the Tom Boy Mining Co., Telluride, Colo., and more recently at the Pinguico mine in Mexico, has been appointed superintendent of the San Gregorio mine of the Dwight Furness Co., of Guanajuato, Mexico.

R. E. Hore, for some time past geologist on the Michigan Geological Survey and instructor in geology at the Michigan College of Mines, has joined the staff of the "Canadian Mining Journal" at Toronto, Ont. He is a graduate of the University of Toronto.

George Watkin Evans, consulting coal mining engineer of Seattle, Wash., has been selected to make an examination as to the commercial posibilities of the Matanuska coal field of Alaska for the United States Bureau of Mines. He left Seattle, May 18, on a preliminary trip.

The New Jersey Zinc Co. announces the following changes in its organization: Herbert G. Clopper, formerly general purchasing agent, becomes general sales manager; Alfred W. Dodd, eastern sales agent; Walter D. Main, western sales agent; E. V. Peters, acting general purchasing agent.

Dr. Wm. B. Phillips, director of the Bureau of Economic Geology and Technology, University of Texas, has just completed a report on the Goltra process for treating brown iron ores, as used by the Missouri Iron Co., Waukon, Iowa. In the test there were used 340 tons of ore from northeast Texas. He is now examining quicksilver properties in the Terlingua district, Brewster County, Tex., and about the middle of June, in company with Dr. J. A. Udden, geologist for the bureau, he will begin an examination of the old San Carlos coal field, Presidio County, Texas.

Louis Ross has brought suit against A. C. Burrage to compel the latter to give Ross, according to contract, 10% of the $25,000,000 capital stock of the recently organized Chile Copper Co., which, it is alleged, Burrage has received in connection with the organization of that company. Mr. Ross alleges that he brought the Chuquicamata copper deposits to the attention of Mr. Burrage and was to receive a share of the stock of any companies organized to take them over. He claims, furthermore, that Mr. Burrage did not disclose frankly and honestly the negotiations connected with the Guggenheims and made misrepresentations.

OBITUARY

C. M. Gooding, a mining engineer, fell from a ladder in the shaft of the old Copperosity mine south of Casa Grande, Ariz., recently, and sustained injuries from which he died while being taken to Casa Grande by auto.

Lord Avebury, better known as Sir John Lubbock, died in London, England, May 28, aged 79 years. Of recent years he had been best known as a naturalist, but at one time he was a student of the currency question whose opinions were considered of importance. He wrote largely on the relations of gold and silver and served on the Indian Currency Commission of 25 years ago.

John T. Brown, for some years vice-president and general manager of the Damascus Bronze Co., Pittsburgh, died at his home in that city, May 20, aged 68 years. He was a well known metallurgist and is said to have been one of the first in this country to manufacture phosphor-bronze. He was a member of the Engineers' Society of Western Pennsylvania. He leaves a widow, three sons and one daughter.

William M. Tilderquist, formerly chief engineer of the Oliver Iron Mining Co., at Hibbing, and more recently superintendent of the North Uno, Herald, Mississippi and South Uno mines on the Mesabi range, died May 19, at his home in Duluth. Mr. Tilderquist had built up a reputation of being one of the best mining engineers in northern Minnesota and had demonstrated that he was capable of handling difficult mining-engineering problems with success. He was a graduate of the University of Minnesota.

George Hampton Smith, 34 years old, one of the Carnegie Steel Co.'s foremost blast-furnace experts, died last week in Aspinwall, Penn., following an attack of pneumonia. After being graduated from high school, Mr. Smith joined the Carnegie Co. as a blast-furnace draftsman and under the tutelage of John Collins and Capt. James Scott, veteran blast-furnace superintendents of the company, he developed into a successful blast-furnace constructor. Within recent years, he had met great success with thin-lined furnaces and had spent considerable time at Mingo Junction, improving and remodeling stacks at that point. Recently he had started to remodel the stacks of the company at the Edgar Thomson works.

INDUSTRIAL NEWS

The Deister Concentrator Co. has purchased and now owns and controls the United States patents issued to Gustave Overstrom on concentrating tables. All orders for Overstrom tables or repairs for same will have prompt and careful attention.

The Witte Iron Works Co., Oakland Ave., Kansas City, Mo., has changed its method of selling Witte gas, gasoline and kerosene engines and hoists and now deals direct with users, the prices being the same as formerly charged dealers. Information concerning these engines and hoists is contained in a new book entitled "Witte Power," which is sent free to those interested.

EDITORIAL CORRESPONDENCE

SAN FRANCISCO—May 28

The Mining Congress at Redding was held May 20-23, and the delegates made three important visits. They visited the Heroult iron smeltery, the Mammoth copper smeltery, and the orchards and farms in the Anderson, Cottonwood, Happy Valley, Churn Creek, Ball's Ferry and the hospital lands in the vicinity of Redding. At Heroult they witnessed the electric smelting of iron ore; at Kennett they saw the smeltery in operation and obtained an insight into the principle of the bag-house for fume treatment; in the farm and orchard districts they saw evidence of the prosperity of the farmers and observed the large crops of fruits, hay and grain. There was no evidence whatever of present or recent damage to the growing crops or the land. They did see a considerable number of digger and bull pines, a few oaks and chaparals, that had been destroyed by the smeltery fumes, but none of these was evidence of recent destruction. Most of them were destroyed in the period when the Mountain Copper Co. was operating at Keswick and roasted ore in the open. There was no evidence of timber damaged by fumes within the last three years. At Kennett, where the Mammoth smeltery is situated, the delegates were entertained at luncheon by the local lodge of Women of Woodcraft, in a grove on the banks of Sacramento River. This grove is an ideal spot for outings and there are fine oaks in it showing not the slightest damage from fume. In fact the visitors found the entire town of Kennett to be one of the garden spots of the county.

Jurisdiction Over Pipe Lines in California will pass into the hands of the state board of railroad commissioners, if the governor signs the bill which was passed by the legislature. The new law will take effect in three months after its passage, within which time the commission will have opportunity to formulate plans of control. The matter will probably be considered first by the law department in order to determine the exact jurisdiction which the law provides. A committee composed of members of the commission will go over the fields and recommend the best method of conducting the business of regulating the pipe lines which will practically become common carriers. It is believed that Governor Johnson will sign the bill. The situation in California respecting the pipe lines is unlike that in the Eastern states for the reason that most of the trunk lines are so situated legally that they do not come under the common-carrier act in the ordinary legal definition of the term. The state railroad commission has been successful in regulating the railroads, particularly regarding freight rates. While the oil lines may in general terms be classed as common carriers to be regulated by common-carrier commission, the relation of the pipe lines to the producer and consumer of petroleum is so different from that of the railroad to the shipper and consumer that the regulation by this commission will not be found an easy task, and it is probable that the new law will meet with legal objections that will cause delay in carrying out of the plans of the railroad commission.

No Damage by Smeltery Fume was sustained by crops in Shasta County, according to the committee appointed by the mining congress held at Redding May 20-23, to investigate the complaint made by the farmers against the Mammoth Copper Co. For the last three years the orchards, and hay and grain fields of Shasta County have produced extraordinarily large crops, but that fact has not restrained the farmers from complaining that crops were being damaged by the escape of fume from the Mammoth smeltery. The recent recommendation by the grand jury that the Mammoth plant should be declared a nuisance and the company prosecuted by the district attorney was found, upon investigation by the mining congress committee, to be based upon an absolute misrepresentation. The statement of the grand jury that the crops and the land of the county hospital had been injured by fume from the smeltery was untrue. The crop of oats grown on the land owned by the county was equal to the best in that part of the state. The potatoes were not damaged and it was expected that an extraordinary crop would be harvested. The alfalfa and fruit on this county land is equal to any in the county. Publicity of these facts coming to the knowledge of the committee upon visiting the county hospital have done more to destroy the false impression in Shasta County regarding the injury of the crops than all other publicity that has been given to the matter. The statements of the grand jury were believed to be true even by some people in Shasta County. The knowledge made public that they were untrue will have much weight in the future regarding the complaints of the farmers.

DENVER—May 30

The Ore Testing Plant Appropriation bill granting $40,000 for a plant at the state school of mines at Golden has been vetoed by Governor Ammons; shortage in state funds being given as the reason.

Gilmore Ores Are Low Grade notwithstanding the fact that rich streaks were recently discovered. The ore has an average assay value of about $10, chiefly in gold, and as the district is 45 to 50 miles from a railway, the ore will have to be treated at the mines. The real discovery of the camp dates back to 1894 when Nelson Peterson staked the three lode claims on which Gilmore made his sensational strike last October and which were then owned by the Lawrence Mining & Prospecting Co. and have since been purchased on option by Gilmore, the first payment of $1000 being due July 1. The purchaser is known as the August Mining Co.

Presidency of the School of Mines at Golden will be filled by Dr. Regis Chauvenet, who was elected president emeritus, at a meeting of the board of trustees, May 24. Victor C. Alderson was retired as head of the school and W. G. Haldane was elected acting president. The faculty will be reorganized. Dr. Chauvenet was president of the school from 1892 to 1902 and brought it to a high state of efficiency. W. G. Haldane is assistant professor of metallurgy. At the annual banquet and meeting of the alumni association, the following officers were elected: President, W. D. Milliken, '93; vice-president, O. R. Whittaker, '98; secretary, M. D. Draper, '97; treasurer, W. O. Chamberlin, '05; chairman of executive committee, Harry J. Wolf, '03.

BUTTE—May 28

An Important Discovery of Copper appears to have been made recently in Flathead County, the details of which have just been made public. Aug. 13, 1912, two prospectors, Joseph Morris and John Hennessy, found a wide vein at a place 35 miles south of the Great Northern R.R. near Coram. The outcrop was traceable for a length of two miles, and it ranged in width from 10 to 20 ft. They located five claims known as the Big Copper Nos. 1, 2, 3, 4, and the Noble Copper. Several cuts were made and pits were sunk on the vein, showing good copper and silver ore. For the purpose of developing this district the Flathead Development Co. has been organized by Butte, Spokane, and Kalispell men, among whom are General Charles S. Warren, L. O. Evans, and John M. Murphy, of Butte; Frederick Oliver, and V. D. Williamson, of Spokane; and Dr. W. H. Campbell and A. Ingraham, of Kalispell.

An Electric Road from Billings to the mining camp of Cooke City, in Park County, has just been surveyed, and a plan of the route has been placed on file in the Billings land office. The reason for this action is that the right-of-way crosses a national forest reserve between the Clark Fork valley and Gardiner. The Eastern Montana Electric Railway Co. was organized last year by Billings men to promote this project, the officers being A. C. Logan, president, George F. Bennighoff, secretary, and F. A. Kesselhuth, chief engineer. During the summer and autumn, surveys were made from the west end of Montana Ave. in Billings, through Laurel, and up the Clark Fork Valley. During the winter a corps of engineers, extended the survey to Cooke City, and also made an examination of a route between Cooke City and Gardiner, at the northeast corner of Yellowstone Park. The proposed line would have a length of 62 miles, and the intention is to equip it for both freight and passenger service. The completion of this road would mean the reopening of a mining district that has been practically abandoned for many years owing to its inaccessibility and the prohibitive cost of shipping ore.

SALT LAKE CITY—May 26

The Bluster Consolidated Property at Jarbidge, Nev., has not been sold to John A. Jess, representing the Potter Palmer Estate of Chicago. This report was widely circulated by a stockholder in the company when Mr. Jess acquired an option on certain stock of the Bluster Consolidated Gold Mining Co., and in which, if the option had been taken up, a Mr. Palmer of Chicago would have had an interest. The Potter Palmer Estate has no interest in any mine at Jarbidge. A report was circulated that a large mill would be built, which also is without foundation.

Silver King Consolidated has again brought suit against the Silver King Coalition company, this time for the amount of $750,000, or three times the value of 5000 tons of ore alleged by the plaintiff company to have been mined in the last five years, by the defendant company, vertically beneath its Electric Light, Cumberland and Ural claims at Park City. On an affidavit made by Solon Spiro, president of the Consolidated company, Judge J. A. Marshall of the U. S. District Court ordered the Coalition to show cause why an order should not be issued allowing the Consolidated company to send its surveyors into the Silver King mine to survey all openings that have been made in the direction of the above mentioned claims of the defendant company. Spiro states in his affidavit that the defendant company has for 10 years maintained the policy of denying access to any of the workings of its mines to men not in that company's employ. By reason of a previous suit brought by the Consolidated against the Coalition company for an accounting for ore mined by the defendant company from the Vesuvius claim, owned in common by the two companies, ("Journal" Apr. 19, 1913) and which was won on appeal by the Consolidated, some of the Consolidated's officers became acquainted with certain portions of the Silver King mine of the defendant company. The workings of this mine are said to be very extensive and a shaft has been sunk to a depth exceeding 1300 ft., at which level, extensive drifts have been driven especially to the westward, and the claims which these drifts underlie could only be determined by careful survey, according to Spiro's affidavit. It was only about one year ago that the plaintiff company heard that ore was being illegally taken from its grounds, and it now claims to have definite and positive information that such ore has been mined by the defendant company. The affiant states that the management of the Coalition company has allowed many of the alleged openings in Consolidated ground to cave so as to be dangerous or inaccessible, and it is further stated that from his knowledge of the character and uniform course of procedure in other cases the affiant believes the manager of the defendant company would, if opportunity permitted, cause the workings now open beneath the plaintiff company's ground to be caved and all drifts leading to them to become filled, or dangerous or inaccessible and for that reason an order for immediate inspection of the ground should be issued.

MIAMI, ARIZ.—May 22

The Recent Cave-in at the Miami mine was an unfortunate accident, which appears to have been due to causes that could not be foreseen. The whole system of work in this mine was to bring down the capping in the northwest orebody just as it has been done in the main orebody, but instead of coming down in sections as it did in the main orebody and had begun to do in the northwest orebody, suddenly a large area dropped away. No one was caught by any falling ground, those killed and injured being thrown down by the air blast. The caved area on the surface was bounded on the west by a vertical escarpment of about 8 ft., showing that there existed along here a fault plane which had never been observed underground, and which evidently was the line of weakness that let the capping down.

NEGAUNEE—May 31

The Michigan Gold Mine west of Ishpeming has been closed down, at least temporarily. This mine has been operated on option for about six months by Morgan Jopling and Morgan Wright, of Marquette. The old workings were reopened and drifts were driven in the quartz, which was so hard that progress was slow and the mill was not operated. The option which was taken from the Michigan Quartz Silica Co. continues and Mr. Wright will remain at the property to estimate on a new plan of development. The mine produced $18,000 in gold when opened about 20 years ago, and the Ropes mine on the same formation produced $700,000.

Revaluing Property in Marquette County is now being done by the tax commission. This is part of the campaign recently started by the officials and tax payers of Michigan to assess all property in the state at its true cash value, thus seeking to equalize mining, manufacturing, farming and residential interests. It is planned to take three years to complete the work, which will be done thoroughly. The mines of Michigan were raised to their real value in 1911 by the Finlay appraisal; other property is assessed at from 40% to 90% of its real value. When the undervalued properties are raised in the proper proportions the mine taxes will probably be lighter.

TORONTO—May 31

Kirkland Lake Gold Camp is of increased interest owing to recent spectacular discoveries and the results of development at the Foster and other properties. Highways are being opened by the Ontario government to facilitate transportation and from $2500 to $3000 per mile will be spent on the road between Swastika and Gull Lake. Several prominent mining men have recently visited the camp and were favorably impressed by an examination of the leading properties. Capt. H. C. Anchor, engineer in charge at the Dome Extension of Porcupine, states that enough ore has been taken out of the shaft of the Foster to pay for all improvements, the property so far as developed being one of the best prospects in the country. Col. Alexander M. Hay, president of the Trethewey, has also returned from an inspection trip to Kirkland Lake highly enthusiastic over the outlook for the field, which presents a remarkable showing considering the short time that has elapsed since its discovery.

COBALT—May 31

Miners Voted Against a Strike at Cobalt, May 25 and now much relief is felt in mining circles. The constitution of the Western Federation of Miners requires a two-thirds majority in order to declare a strike. Two questions were submitted on the ballot; the first was: "Shall we go out on strike immediately." The vote stood 455 for to 390 against. On the second question, "Shall we go out under the Lemieux Act after giving 30 days notice?" The vote was 89 for, to 390 against.

Mine Accidents Increased according to the report of the Bureau of Mines to a notable extent in Ontario in the first part of the present year. There has been an extraordinary increase in the number of casualties both fatal and non-fatal as compared with the corresponding period in 1912. The inspector of mines is at a loss to suggest a reasonable explanation as the accidents are not due to any particular cause nor are they confined to any particular locality, and the increase is shared in all branches of the industry. During the period, there were 21 fatalities in the mines as against eight in the corresponding period in 1912 and in the quarries, four, and the metallurgical works, five, as against no fatalities in these branches last year.

PORCUPINE—May 31

Power Conditions at Porcupine are still further complicated by the fact that during an electrical storm a few days ago, the wires of the Wawaitin Power Co. were struck by lightning and some of the generators were burned out. It is expected, however, that the company will have sufficient power to supply the Dome and the Hollinger and the repair work will be completed as quickly as possible.

English Interests in the Gowganda District increase, and it is probable that they will acquire most of the more important properties. The Mann mine has been under option for some time and it is understood that the same syndicate is negotiating for the purchase of the Miller Lake-O'Brien. The last company controls the Millerett, which was, for some time, the heaviest producer in the district. The owners ceased operations a few months ago and the property was purchased by M. J. O'Brien, principally with the object of treating his ore in the Millerett mill. If these three properties are taken over, the price will be about $1,000,000.

Hollinger Profit from Jan. 1 to Apr. 22, 1913, was $549,894, while the profit for the four weeks ended Apr. 22 was $179,942. This compares with $128,352 for the preceding four weeks and is at the rate of 77% on the capital. During the period, the mill ran 86% of the possible running time, and treated a total of 11,357 tons of ore, of an average assay of $23.44 per ton. This compares with 10,581 tons, of an average assay of $19.61 for the preceding period. The approximate extraction was 95%. This is a particularly gratifying statement, but it must not be forgotten that the greater part of the ore hoisted came from the No. 1 vein, which produces richer ore than any of the other workings. As the estimated average grade of the total ore reserve is $17.50 per ton, it will be seen that the Hollinger will ultimately be forced to treat ore of considerably lower grade. Total cost for this period of four weeks was $6.45 per ton, a reduction of 6½c. per ton as compared with March. The financial statement showed a surplus on Apr. 22 of $541,696. The shareholders are warned, however, that on account of the shortage of power, there will be a large decrease in the production for the succeeding four-weeks' period.

THE MINING NEWS

ALASKA

Douglas Island

ALASKA MEXICAN—In April, 18,795 tons of ore yielded $48,075, or $2.63 per ton, $24,975 being net profit.

ALASKA-TREADWELL—In April, 60,452 tons of ore crushed yielded $150,209, or $2.51 per ton, $58,429 being estimated as profit.

ALASKA UNITED—In April, 18,900 tons of ore crushed in the Ready Bullion Claim mill yielded $37,502, or $2 per ton, $10,170 being the estimated net profit. In the 700 Ft. Claim mill, 19,068 tons of ore yielded $48,161, or $2.55 per ton, $22,780 being net profit.

Fairbanks District

BUNKER HILL—A test shipment of seven tons of ore was crushed at the Garden Island mill, $20 per ton in gold being returned.

17 GOLDSTREAM—An electric-lighting plant is being installed to illuminate the underground workings of the lessees, Peterson and Craig.

TEDDY R.—Five stopes have been opened and preparations are being made for a 300-ton shipment of ore to the McCarty-Fursteneau mill on upper Fairbanks Creek.

NEWSBOY—Immediate resumption of work on this property on the ridge between Cleary and Little Eldorado Creeks has been authorized by the stockholders. The company recently secured $15,000 for the work from stockholders residing at Fairbanks.

CRITES & FELDMAN—Final returns from the recent mill-run of ore at the Willis mill show that 22½ tons were crushed for an average recovery of little more than $130 per ton. The adit, from which the ore was taken, will be driven into the hill as rapidly as possible. It is probable that a small mill will be built this summer.

WILLIS—The mill is engaged intermittently on custom ore. A shaft is being sunk on the right limit of Chatham Creek to tap the Gladstone vein, from which 600 tons of ore milling $20 to the ton were taken last winter. The shaft is now down 65 ft., and arrangements have been made for installing a small gasoline hoist. The shaft is expected to tap the vein at a depth of 150 to 200 feet.

Ketchikan District

RUSH & BROWN—The winze from the second level is down 56 ft., and a small hoist is being installed to facilitate sinking so as to develop the third level.

OLD GROUP—H. S. Waugh, managing director of the Alaska Venture Syndicate, Ltd., of London, England, took over this property from Martin Buggy, of Ketchikan, May 19. The company took an option on the property more than a year ago, and has since expended $35,000 in proving the property. Stamp mills will now be built as well as a hydro-electric power plant of 3000 hp., wharves, bins, and a complete plant for handling large quantities of low-grade, gold-bearing ore. W. Jowatt, of England, is now on his way to the property to take charge of the work. The company also has an option on the Old Glory group.

Ruby Creek District

THE OUTPUT OF THE RUBY DISTRICT, the newest camp in the interior of Alaska, is predicted to exceed $1,000,000 for the season. Long Creek is said to show six miles of pay, and the discovery of pay is reported on Bear Pup, Fourth of July, Midnight, and Greenstone Creeks, all tributaries of Long Creek. On the Salatna side of the divide, pay has been found on Tamarack and Poorman Creeks, and in Glen gulch.

Valdez District

NORTH STAR—A shaft has been sunk to a depth of 50 ft., and more gold than silver was found in a 2½-in. vein at the bottom.

KENNECOTT MINES CO.—Much work has been done on the Jumbo mine, and the property is said to be looking better than the Bonanza did with the same amount of work; it is expected that it will be a bigger shipper. A compressor was recently installed and a transmission line has been built from the power house of the Bonanza to the Jumbo.

ARIZONA

Gila County

NEW KEYSTONE COPPER CO.—Judge Shute, at Globe, granted this company a temporary injunction May 27, restraining Inspiration Consolidated from further work in the main haulage drift through Keystone ground.

ARIZONA COMMERCIAL—At the Copper Hill shaft development work is being continued at a brisk pace. The shipments of ore are still small, for sinking and other development work on the program of the management require the greater part of the working force of 40 men. The shaft will be bottomed within a week at a depth of 1200 ft., and drifting from the bottom will be begun.

IRON CAP—About 275 tons of ore had been shipped to the El Paso smeltery May 27; another car holding 54 tons was ready for shipment, and it was expected that before the end of the month still another of about the same tonnage could be shipped. The output for May exceeded the management's estimate of 300 tons for the month's production. The ore on the 650-ft. level is as rich and as wide as it was when first reached, and the same 2-ft. stringer of unusually rich copper glance and high-grade silver still appears in the face of the drift. The company is greatly bothered by the shortage of cars, and could have shipped much more ore. All the May shipments were made after May 10, as labor troubles at the El Paso smeltery made shipping impossible prior to that date.

SUPERIOR & BOSTON—Production was retarded in May by the labor strike at the El Paso smeltery and subsequent shortage of cars, which was partly due to the fact that every car emptied in the Miami district was used for returning shipments of concentrates and ore, the Black Warrior alone shipping about 4000 tons of ore during the month. The week beginning May 26 was marked by congested ore bins on the surface and packed ore chutes underground. The Arizona Eastern R.R. is endeavoring to supply the needed cars and has ordered three more daily from the Southern Pacific, but up to the end of the month no relief had been obtained. The showing in the sublevel, 140 ft. below the sixth level, continues excellent, both the east and west faces being in excllent copper ore. Elsewhere the aspect of the mine is more promising than at any time during its existence.

INSPIRATION—Work on the railroad grade between the main east and west shafts and the millsite is being done at a normal rate, but all work at the millsite is at a standstill pending the result of the flotation tests being made at the experimental mill. To date the tests are supposed to have been satisfactory, but until ore from every part of the mine has been treated nothing definite in the way of mill construction will be planned. The persistent rumors of immediate erection of a 600-ton experimental mill seem to be without foundation, the test mill now in use being adequate for all testing purposes. Purchases of material, to be used in the test plant, have been made by the company, but the material is of such nature that it could be used for the mill as originally planned in case the flotation process is not adopted. Near the Geneva mine a crusher plant is being erected for use during the erection of the mill, and between that place and the millsite a large bin for screening and storing sand and gravel for use in the construction of the concentrator, is nearly finished.

Maricopa County

VIA MINING CO.—A shipment of matte has been made to the Copper Queen smeltery at Douglas, by this company, which has a small smelting plant at Roger's Springs, nine miles west of Cave Creek.

Santa Cruz County

MANSFIELD—The Lee shaft is 300 ft. deep, and as soon as the cable recently ordered arrives, sinking will be resumed.

R. R. R.—Pending the settlement of the strike of the laborers at the El Paso smeltery, this company has cut down its shipments and is shipping to Hayden. Advantage of the occasion is being taken to install a new 50-hp. hoist.

MORNING GLORY—This low-grade copper property has been sold to the Ajo Consolidated Copper Co., which desires the ore for its iron for flux. A tunnel being driven to tap the vein at 400 ft. lacks about 50 ft. of cutting the vein.

GREAT SILVER—George F. Wieland has bonded this group of five claims to W. R. Johnson, of Douglas. The claims have produced good ore and are in the Jefferson district. Mr. Wieland has also bonded his zinc claim in the same district to F. E. Thayer and others, who intend to ship ore.

Yavapai County

COPPER HILL—This mine has not been operated since 1908, but it is to be examined in the near future to determine the value of the molybdenite in the ore.

COMMERCIAL MINING CO.—This company has shut down at the 500-ft. shaft and in the workings at depth, and is now confining operations to extracting the oxidized ore previously exposed to the west of the shaft, of which it is shipping 25 tons per day to Douglas.

CALIFORNIA

Amador County

KRISS—Operations at this gravel mine near Volcano have been resumed.

DEFENDER—A Lane 40-ton roller mill will be installed at this property; 5 of the 10 stamps in the mill will be used for crushing the ore before it goes to the roller mill.

BUNKER HILL—This mine has paid 83 consecutive monthly dividends, the last having been paid May 15 at the rate of 2½c. per share, or a total of $5000. The monthly output has lately ranged from $20,000 to $30,000. The decrease in the rate of dividends has been due to development expense and new equipment, including a hoist.

Butte County

BERRY CREEK—It is reported that machinery will be installed for development. John Kincaid, of Berry Creek, is superintendent.

GOLD BANK-GOLDEN QUEEN—It is reported that a large shoot of medium-grade ore has been disclosed by recent development work in a drift about 1000 ft. below the surface. The shoot has been shown to extend 100 ft. deeper to the next level below. The ore is within the Gold Bank claim and near the west line, which separates it from the Golden Queen. The mine was reopened this year and is being developed, a 20-stamp mill and a 75-ton cyanide plant being operated. M. J. Cooney, of Forbestown, is manager.

Calaveras County

ETNA-KING MINING CO.—Assessment No. 32 of 1c. per share has been levied upon the capital stock of the corporation, payable at Stockton. Samuel S. Cohn is secretary.

Kern County

CONSOLIDATED—The mill at the Good Hope is now running with three shifts. A mill-run test is being made from the screenings.

KING SOLOMON—The latest cleanup from the Teagle-Lamberson lease averaged $32 per ton, 68 tons having been treated. The Wickard-Walton lease has 12 tons of ore in the bin which is said to be of better grade than is mined by other lessees. Eight tons are in the bin at the Watchman & Tait lease.

MINNESOTA-JOSEPHINE—This group has been secured on a 45-day option by J. W. Kelly and others of Bakersfield. The option called for a two-year bond and lease. The property is two miles west of Randsburg. It is stated that there is a vein of low-grade ore 6 ft. wide, which can be cyanided. The property has been prospected by shafts and tunnels. The deepest opening is at a depth of 150 feet.

Modoc County

YELLOW JACKET—The shaft has been sunk to a depth of 75 ft.; the drift is reported to have disclosed a 15-ft. vein. The claim is operated on a lease by the Spearmint Mining & Leasing Co. N. E. Guyot is manager.

Nevada County

GOLDEN CENTER—This property in the center of the business part of Grass Valley is being reopened. Recently the name has been confused with the Golden Scepter, and it was said that action against the Golden Center was to be made by the Southern Pacific claiming the land under Government grant. The railroad has made no claim to title to this mine. The full name of the corporation is Golden Center of Grass Valley Mining Co. The name of the company which the railroad sought to oust is the Golden Scepter Mining Co., which property is outside of the town of Grass Valley. The property, which is being reopened within the town, was a producing mine in the early days.

Placer County

PIONEER—A cyanide plant is being built. The ore is reported to be of high grade and of sufficient value to make milling on the ground more profitable than shipping.

HELLESTER—This company has made an underground survey of the Rawhide mine for the purpose of locating proposed drifts and raises, and to ascertain the amount of ore that has been mined.

MAYFLOWER—Preparations are being made for the building of a mill by the California Black Sand Extraction Co. It is reported that there is a large quantity of sand that shows good results from test runs.

Plumas County

PROVIDENCE HILL—The tunnel in this channel mine on Rush Creek is reported to have reached the 1500-ft. point. Joseph Adams is owner. The mine was formerly worked by hydraulicking, but was shut down when the anti-débris law was passed.

CLAY BANKS—It is reported that this property in the La Porte district will be reopened. Work has been irregularly and indifferently done for the last five or six years. A tunnel about 5000 ft. long has been driven to tap a channel, which is believed to be the southwest continuation of the Gibsonville Ridge channel on which the Thistle shaft and Bellevue tunnel mines are situated. John Thomas, of La Porte, is manager.

Shasta County

WEST END—It is reported that this mine near French Gulch is to be reopened by the Mt. Bully Gold Mining Co., and that machinery has been secured and will be immediately installed.

PORTER-THOMPSON—The last load of machinery and parts for the dry-land dredge has arrived at Igo. It was freighted by team from Anderson. The dredge was to be ready to go into commission about June 1. The dredge was invented by Hearnes and Martin.

SHASTA MINING & DREDGING CO.—This company, which has been operating a bucket elevator dredge at Horsetown, on Clear Creek, is reported to have taken a bond on 480 acres at Gas Point, 20 miles west of Redding. It is said to be the purpose of the company when the present ground is worked out to build a new hull and move the machinery to Gas Point, provided the prospecting warrants the dredging of the new land.

Trinity County

CORONA DE ORO—It is reported that platinum in commercial quantities is being recovered besides gold. The property was reopened last year and the development work and installation of machinery and flumes has been done and the mine put on a paying basis without incorporating. W. E. Olmsted is manager and principal owner. The mine is on Trinity River near Hawkins Bar.

Tuolumne County

LOUISIANA—A new hoist has been installed. The shaft is 130 ft. deep and it is being sunk to the 300-ft. level.

HARVARD—A new Lidgerwood hoist is being installed, and will be operated by a 300-hp. electric motor. The drums have a capacity of 5000 ft. of 1⅛ in. cable; 4-ton skips will be used. Harry Gould of Jamestown, is superintendent.

EL ORO—A new road is being built to connect with the county road. The new shaft, now 75 ft. deep, is being timbered. The shaft will be deepened to 200 ft. an electric hoist will be installed and a headframe erected. There is a 2-stamp mill on the property, but it is expected that a new mill and cyanide plant will be built later. R. H. Warburten of Tuolumne is in charge.

COLORADO

Boulder County

A 4000-FT. DRAINAGE AND TRANSPORTATION TUNNEL for the Nederland tungsten veins is to be started soon. The Primos Chemical Co. is said to be interested and other veins than those owned by the Primos company, will be opened.

BOULDER METAL MINES ASSOCIATION—This company abandoned work May 31; it is said that its operations were unprofitable.

Clear Creek County

BELLEVUE-HUDSON—On the 1100-ft. level stoping is in progress on a 3-ft. vein containing an 8-in. streak of smelting ore assaying $80 per ton.

GOLD & SILVER COIN—The shaft being sunk on this Ute Creek property has opened a 3-in. vein assaying 1 oz. gold and 700 oz. silver per ton. The discovery will probably have the effect of stimulating development in the locality.

DORIT—The grading for the new 60-ton concentrating mill in Chicago Creek has been completed and the sills for the building have been laid. The contractor, John A. Traylor, will attempt to complete the plant and place it in operation within 60 days.

REFUGEE—The underground workings of this property are being surveyed preparatory to the beginning of systematic development. The company intends to drive levels and extend raises to thoroughly prospect the vein before laying any plans for the resumption of production.

PIONEER—The old workings of this property near Empire, are being thoroughly explored with favorable results. New territory in the mine is being developed and considerable milling ore is being produced from old stopes. The Pioneer mill is in operation, and the concentrates are being shipped to the Chamberlain-Dillingham Ore Co., at Idaho Springs. S. L. Work is manager.

McKELVEY MILL—The remodeling of this plant at Idaho Springs is in progress. A set of Harz jigs and three Wilfley tables will be added to the equipment. In this plant the usual milling process is reversed. The ore is first concentrated and the tailing is then passed through the McKelvey amalgamator. It is claimed that $2 ore can be treated at a profit. The mill will resume operations in about 30 days.

GEM—Lessees Coe, Christenson & Co., operating through the Newhouse tunnel are maintaining regular shipments of $15 ore. The east drift has been advanced to a total length of 900 ft., the last 300 ft. of which has developed considerable pay ore. On the 14th level, lessees Ford & Co. are making regular shipments of mill ore to the Argo mill at the portal of the Newhouse tunnel. A block of ground 500 ft. long and 600 ft. high is being explored.

YOUNG AMERICA—This property, on Red Elephant Mountain, near Lawson, is owned by the Little Giant Gold Mining Co. The property is now operated by lesees, but extensive development on company account is under consideration. The company will probably operate through the Tabor tunnel. Lessees Lang & Hayden have recently drifted 50 ft. on a 10-in. vein assaying 90 oz. silver per ton. The vein looks as well in the breast as at any place in the advance.

GEORGETOWN TUNNEL—A contract has been let to advance this tunnel 100 ft. to a total length of 580 ft. It is reported that this contract is the beginning of an extensive campaign of development to be undertaken by the Georgetown Tunnel Transportation Co. The company contemplates systematic exploration of its own and other properties on Columbia and Democrat mountains, and many consider the installation of a compressor plant and other equipment required for enlarged operations.

Eagle County

LADY BELLE—This mine has shipped five carloads of high-grade silver ore to the smeltery. The returns from the first carload were $82.50 per ton.

Lake County—Leadville

WORK IS HAMPERED AT LEADVILLE, excepting at the large mines, by snow and surface water. In Lackawanna and Half Moon Gulches snow is still keeping out the prospectors and miners. In the Tennessee Pass section, however, the season has opened and work has been resumed. The Helen Gould and Copper King are being worked and the Maupin Bros. are working three claims. Placer mining in the gulches has also been begun. On Fryer Hill the Chrysolite lessees are sending out a small tonnage of ore of fair grade, and the Ponsardin lessees have opened iron ore of good grade and are shipping regularly to the smeltery. In Evans Gulch the Little Ella lessees have good ore and are keeping teams busy hauling the product.

MOUNT CHAMPION—Surveys for an electric power line are being made up Half Moon Gulch and across to Lackawanna Gulch by the Colorado Power Co. Power will be supplied to this company for its mill and mine machinery. The Miller Gold Mining Co., operating in Lackawanna Gulch, has its own hydro-electric plant, but as the water supply has been frozen each winter it will probably use power supplied by the Colorado company.

San Juan Region

BUTTERFLY-TERRIBLE—The lessees are now employing about 20 men. Both mine and mill are in operation.

JUNTA—A force of 35 men is employed in building the new mill in Bear Creek Gulch. F. L. Veach is directing the work.

SILVER LEDGE MILL—This mill has been leased by Joseph Warner, who will operate it as a custom plant. He expects to get ore from the Joker tunnel, near Ironton, the Guadalupe, Congress and other Red Mountain mines.

OLD LOUT—This mine, in Poughkeepsie Gulch, which was named for Loutsenheiser, its discoverer, is about to produce again, and it is expected that from 5 to 10 tons of ore per day will be shipped to the Brown Mountain smeltery at Ouray. The vein is about 25 ft. wide and is developed at a depth of

1800 ft. below the surface by a crosscut tunnel. There are two ore streaks, one of copper and the other of silver-lead ore. The average assay value is about $25 per ton.

Summit County

IN THE BRECKENRIDGE DISTRICT the season opens with every prospect of success for the three gold-dredging companies and for the lode mines. The Simcoe company's new strike in the Country Boy mine is a 4-ft. vein, which yields high-grade blende. The Wellington Mines Co., which paid $150,000 in dividends last year, is running both its concentrators full time, producing zinc-blende concentrate and nearly 300 tons of silver-lead ore monthly. The Standard mine, on Gibson Hill, shipped two carloads of lead ore in May. It is stated that the Reiling dredge, in French Gulch, cleaned up 600 oz. of gold in 10 days, the product being valued at $9690. The other two dredges are making regular shipments of gold bars to the Denver mint. The Bullion King, on Gibson Hill, has struck a 3-ft. vein of blende containing about 11 oz. silver per ton.

Teller County—Cripple Creek

SCHOOL SECTION—A discovery of new ore has been made in this Bull Hill property on the 650-ft. level.

UNITED GOLD MINES CO.—Production will be increased to 750 tons per month, hoisting facilities having been improved and ore bins enlarged. The ore comes from the W. P. H. and Wild Horse, in which mines several new oreshoots have been opened.

STRONG—It is stated that ore from this mine and the dumps at Victor will be treated at the Colburn mill at the Ajax mine, said to have a capacity of 300 tons per day. An aërial tram will be built from the Strong to the Ajax, a company having been incorporated for that purpose by William Lennox and E. A. Colburn.

IDAHO

Coeur D'Alene District

LACLEDE—Development work will be resumed at this property after the winter shutdown. This is one of the most promising properties in the district. It is located between the Tamarack and the Hercules mines.

HAMBURG-AMERICAN—A contract will be let for 100 ft. of drifting at this property on the north side. Considerable work has been done already and in the lower workings some good copper ore has been developed. A drift will be driven under the best surface showing.

MOONLIGHT—After a shutdown of 10 days on account of high water, operations will be resumed at this property at Burke. Work is now confined to the tunnel which will cut the vein at a depth of 1400 ft. The tunnel is already in 1000 ft. and the ore, it is expected, will be encountered within the next 100 feet.

MICHIGAN

Iron

U. S. RESCUE CAR NO. 8 is on the Marquette range for a period of three weeks, after which one week will be spent in the Gwinn district before returning to its permanent station at Ironwood. Rescue and first-aid work in the Marquette and Gwinn districts has become very proficient due to the careful attention it has received since the disastrous fire in the Hartford mine, two years ago.

CLEVELAND-CLIFFS IRON CO.—Two diamond drills are being operated at Negaunee, one at North Lake, one on the Peterson farm west of Ishpeming, which is under option, and one underground at the Cliffs Shafts mine, besides several in Iron County.

CHATHAM—This mine of Ogelbay, Norton & Co., at Iron River, has resumed mining operations after a shutdown of two weeks for improvements. A new headframe, gyratory crusher and dynamo were installed while the mine was idle. All the underground haulage on main levels will now be done by electricity, for which purpose the dynamo was installed.

RICHMOND—This opencut mine of M. A. Hanna & Co., on the Cascade range, is active and will this season ship 150,000 tons of low-grade, siliceous ore, which will be the largest shipment since its opening in 1896. The ore is blasted with black powder and dynamite, is shoveled into small cars by steam shovels, drawn to the crushers by "dinkey" locomotives, crushed and loaded into railroad cars for shipment over the Chicago & Northwestern R.R. to Escanaba.

MISSOURI

Sainte Genevieve County

CORNWALL COPPER MINING & SMELTING CO.—The property of this company is at Sainte Genevieve in the southeastern Missouri copper district about 70 miles south of St. Louis, and between the so called lead belt and the Mississippi River. Two places in the district seven miles apart were opened many years ago and worked quite extensively from 1880 to 1884, the ore being at that time sorted to 20% copper and hauled by team to the Mississippi River and from there shipped by boat to Baltimore. Later a smeltery was erected at the river and still later a small furnace was put up on one of the properties in the district. This, however, has been dismantled. A few years ago the Illinois Southern R.R. was built from the coal fields of Illinois to the southeastern Missouri lead belt and this road passed through the copper region. The ore, which occurs in zones of local fissuring, lies in flat sheets dipping about 5° from the horizontal, and in some places more than one floor of ore exists. Originally precipitated as chalcopyrite, free from pyrite, the ore locally has been oxidized and enriched. About 80 men are employed. The ore as mined assays about 8% copper, and is roughly sorted in the sampling plant to 10 to 11%. The company has a three-mile spur road on which a gasoline engine is used and it operates a 15-drill compressor day and night shifts. Considerable activity prevails in the district. Engineers from the Federal Lead Co. are studying the country and are reported to have optioned heavily. Boston people control the Cornwall company.

MONTANA

Broadwater County

KEATING—Owing to the fact that work on the branch line of the Milwaukee railroad from Three Forks to the Radersburg mining district was discontinued for financial reasons after being partially completed, the output of this mine at Radersburg was curtailed early last year, and, looking to early resumption of work on the road, special attention was given to development rather than to mining. The shaft has been sunk to the 800-ft. level, where considerable ore has been blocked out. Machinery, increasing the pumping capacity, has also been installed. Sufficient ore has been mined and shipped to pay the running expenses of the property.

Deer Lodge County

BONANZA—At this mine, near Silver Lake, a large body of ore has been blocked out; assays range, it is said, from $10 to $50 per ton in gold and silver.

GOLD COIN—The suit of W. A. Franklin, and J. C. Mott, against Chris Yegen and associates, owners of this mine in the Georgetown district, was dismissed May 26, by Judge Winston, of Anaconda. Franklin and Mott began work on the property in the summer of 1911, under a lease and option, Andrew Prader, accredited sales agent for the owners, negotiating the deal. Later in the year the lessees stopped work after a difference with Prader, and filed suit for $100,000, alleging that the interference with their operations had caused them to lose that amount. In the course of the suit it was demonstrated that Prader had no general authority as agent, but that his agency was limited solely to the sale of the property, and that, therefore, his action in the case was not binding upon the owners.

Gallatin County

GARFIELD MINING CO.—This company owns a group of five mine claims 13 miles from Belgrade and 18 miles from Manhattan. Development work has been done on a small scale for three years. A 450-ft. tunnel has cut a vein of gold-silver-copper ore that ranges from 9 to 20 ft. in width. A survey has been made for a lower tunnel which will be driven with the intention to cut the vein at depth and below the zone of oxide ore.

Granite County

SHAKESPERE—The mill at this gold property, in the Antelope mining district, is being equipped with new machinery for treating slimes. The leaching plant is being remodeled, a shipment of tanks and other equipment having recently arrived.

NORTHERN BELL—Preparations are being made to resume operations at this property on Boulder Creek. Additional financing is now being attempted by the company for the purpose of sinking the shaft to greater depth and for further development work.

Jefferson County

BLUEBIRD—This company, operating a copper property in the Wickes mining district, is hauling ore regularly to the railroad at Wickes, four 6-horse teams being used. The Mount Washington mine in the same district is also shipping ore by wagon.

Lewis & Clark County

EASTON—A new cyanide plant has been completed at this mine near Virginia City, and work will be started at once.

BALTIC COMBINATION—The vein which was opened some time ago at this property in the Georgetown district has been drifted on for a length of 115 ft. developing ore of good width and grade for the entire distance. Sinking on the oreshoot is now in progress, the ore improving with depth.

CONREY PLACER MINING CO.—The season's work has been started by this company operating in Alder Gulch near Ruby. No. 3 dredge has just begun operations, and according to Superintendent Charles Kammerer, No. 4 dredge, which has been undergoing repairs all winter, is ready for operation and will be started at once.

CUPRITE COPPER MINING CO.—This company was organized some time ago by New Jersey and Montana men for the purpose of operating a group of six claims 12 miles from Helena and eight miles from Marysville. The shaft, which is being sunk under the direction of President P. L. Reece, of New Jersey, has reached a depth of 212 ft., and crosscutting to the vein has been started. The ore contains gold, silver, lead and copper.

NEVADA

Clark County

ELDORADO CANYON DISTRICT appears to be coming to the front once more, the Wall Street group of mines having been optioned by a syndicate which has also taken options on other good properties.

HOMESTEAD—This mine, formerly known as the Good Hope, is now being worked by lessees, all of whom are said to be doing well.

QUARTET—This mine is leased to Charles Jones, who is making from $10,000 to $15,000 per month from ore shipped. A sublessee has broken into ore 10 ft. wide that plates $20 per ton.

PORTLAND—A tunnel is being driven, in this mine, on Dougherty Mountain, to make connection with the main shaft. When the vein is cut 200 ft. of stoping ground will be available above the tunnel on a promising rich oreshoot that has been uncovered from above.

DUPLEX—Development work in this mine, at Searchlight, has been going on for 18 months and enough ore is now blocked out to supply a 50-ton mill. A mill will probably be built in the near future. As depth is gained the ores are becoming base and little of the gold and silver in this ore can be recovered by amalgamation.

Humboldt County

A GEOLOGICAL EXAMINATION of the Rochester mining district will, it is reported, be made by F. C. Shrader of the U. S. Geological Survey.

BIG FOUR LEASE—A contract has been made with freighters to ship 100 tons of ore daily. A compressor and hoist will be installed.

COLLIGAN LEASE—Ore assaying $70 to $90, two-thirds of it gold, was struck in the north drift from the bottom of the winze. This ore has widened from 8 in. to 4 ft., and the grade tends to improve with increase in width of the vein. A tunnel is being driven to cut the vein 150 ft. below the present bottom level.

Lyon County

PINE GROVE—Grading for the mill is completed.

MATT—This mine in Mason Pass is a regular shipper to the Thompson smeltery.

MASON VALLEY MINES CO.—Ore received at the Mason Valley smeltery for the week ended May 23, 1913, was as follows: From Mason Valley mine, 2159 tons; from Nevada-Douglas, 1474 tons; from other mines, 1211 tons; total, 4844 tons; daily average, 692. In the same week eight cars of matte were shipped.

Mineral County

AURORA ORE PURCHASING & REDUCTION CO.—Articles of incorporation of this company have been filed at Provo, Utah. The capitalization is 1,000,000 shares, par value of 10c. per share. Grading for the mill is in progress. The mill will consist of stamps, plates and concentrating tables. A compressor will be installed. At the mine, development on three levels is in progress. The ore assays $5 to $8 in gold.

Nye County

SHIPMENTS in tons from Tonopah mines for the week ended May 24 were as follows:

Tonopah Mining	3,150	North Star	200
Tonopah Belmont	3,564	Mizpah Extension	....
Montana-Tonopah	1,010	Jim Butler	450
Tonopah Extension	1,120	Tonopah Merger	220
West End	770		
Midway	50	Total	11,114
MacNamara	580	Estimated value	$245,050

UTAH

Beaver County

MAJESTIC—Net profits for the first three months of 1913 are given as $10,975. April and May shipments from the Old Hickory show an increase, and ore reserves have been added to.

MOSCOW—Much development, during which production was curtailed has been carried on during recent months, and new faces of ore have been opened on the 400-, 600- and 700-ft. levels. It is thought that from now on the weekly output will be from four to five cars.

Juab County

IRON BLOSSOM—Ore of unusually high grade is being mined from between the 500- and 600-ft. levels.

GEMINI—A dividend of $10 per share, amounting to $50,000 has just been paid. Lessees, of which there are 60 sets, are working on the upper levels of the mine.

Salt Lake County

UTAH COPPER—The regular quarterly dividend of 75c. per share has been declared, payable June 30. More than 20,000 tons of ore is being mined daily, and it is thought the May output will exceed 10,000,000 lb. of copper.

OHIO COPPER—With the notification that the annual meeting will be held June 4 at Portland, Maine, a statement signed by the board of directors has been sent to stockholders describing present conditions. Operations during the first quarter of the year were unsatisfactory owing to the unusually severe weather of January and February, which was followed by a thaw the latter part of February and resulted in the washing away of the tailings dam. The construction of the third section of the mill has been completed, and in April 71,225 tons of ore was treated. Mining, milling and transportation costs amounted to 82c. per ton. Present monthly profits are estimated as exceeding $20,000. A communication from the general manager quoted in the statement, reports a face of ore assaying 2% copper recently opened on the Mascotte tunnel level in driving to the east from the crosscut a short distance in the foot wall of the "All's Well" vein. In April 690,001 lb. copper was shipped, the average copper content of the ore having been 1.045 per cent.

Summit County

AMERICAN FLAG—High-grade ore has been opened recently in raising from the 1000-ft. level. A car of this ore is ready for shipment.

SNAKE CREEK TUNNEL—Work will be resumed shortly under a new contract in this drainage, transportation and development tunnel.

NEW YORK BONANZA—This property has been closed down for several months. A special meeting has been called to consider ways and means for future development.

DALY WEST—The quarterly dividend for the second quarter of the year was passed by this company in April. The reason given being that much development work is in progress and a reserve in the treasury is desirable. Development is being done under contract with the McIlwee company, of Denver.

THOMPSON-QUINCY—A special stockholders' meeting will be held June 21 to consider and ratify the action of the directors in issuing $75,000 in bonds maturing in five years bearing interest at 6% per annum, and exchangeable in treasury stock at 50c. per share one or three years from the date of the issue.

SILVER KING CONSOLIDATED—Ore has been followed for more than 20 ft. in the company's main working shaft, which is being sunk from the 1300- to the 1800-ft. level. It was cut at the 1480-ft. point. The ore is rich in lead and silver, and carries some gold. The strike has been attracting considerable attention.

DALY-JUDGE—Work continues in the new orebody along the contact of limestone and shale, which was found by raising from the 900 level. The ore contains lead and silver. About 30 tons is being mined daily. Crosscutting has been started, and in addition to the shipping ore, considerable second-class or milling ore will be mined.

Tooele County

SHIPMENTS OF ORE FROM DRY CANYON have begun with the opening of the roads. There is estimated to be more than 1000 tons of ore on the dumps.

GALENA KING—Lessees are blocking out ore.

BEN HARRISON—This mine at Stockton shipped seven cars of ore in May.

WASHINGTON

Chelan County

SQUAW SADDLE—Ore carrying quicksilver has been discovered on this property on Squaw Saddle Mountain.

Okanogan County

OWASCO—This mine near Oroville is to be equipped for electric power and operations will be increased during the coming season.

CANADA

Alberta

HILLCREST COLLIERIES—A contract has been entered into with the Canadian Pacific Ry. under which it will take the entire output of the mine for a period of five years.

British Columbia

WAR EAGLE—A press despatch states that the shaft at this mine, at Rossland, caught fire June 2. The shaft house was destroyed, but no loss of life is yet reported.

Ontario

CANADIAN HOMESTAKE—Provision has been made for a year's active development of this mine in the Lake-of-the-Woods district. The company has arranged for a supply of electric power from the town of Kenora, taking at present 200 hp.., until a large stamp mill is installed when it will require 1000 horsepower.

Ontario-Cobalt

SILVER CLIFF—The mill, after being closed down for 18 months, has been started and is treating between 50 and 60 tons daily. About 3500 tons of milling ore is on hand.

MANN—This Gowganda property is under option to an English syndicate. The high-grade oreshoot which has been developed at the 90-ft. level has been encountered on the 150-ft. level.

NORTH STAR—This company has been organized with capital of $1,000,000 to take over the Belmont mine which has been operated for several months by James Currie, of Toronto. A shaft 65 ft. deep has been sunk on three veins running in from the Drummond.

SILVER BAR—At this mine now being operated by the Preston-East Dome company, 6 tons of high-grade ore is ready for shipment. This ore has been extracted in the course of stoping and development below the 50-ft. level, where a good oreshoot has been developed for 20 feet.

PETERSON LAKE—The annual meeting, held May 26 contrary to expectations was entirely harmonious, the campaign to secure a controlling interest for a purchasing syndicate having fallen through. The financial statement showed profits for the year of $95,914 and a balance of $127,980 was carried forward. The shaft is now down to 110 ft. The lake area to the south will be reached by crosscutting and underground exploration will be carried on near the Huronian-Keewatin contact.

Ontario-Porcupine

THREE NATIONS—The new 5-stamp mill has been completed, and will shortly be in operation.

FOLEY-O'BRIEN—Diamond-drilling operations are in progress on this and adjoining claims. The drill holes will be put down to a depth of about 400 feet.

TECK-HUGHES—The Orr vein from 4 to 5 ft. in width showing free gold has been encountered. Another vein 200 ft. north of this has been discovered. It is about 4 in. wide and carries high-grade ore.

BURNSIDE—On this property in the Kirkland Lake district the shaft is down 25 ft., at which depth the vein is well defined and about 1 ft. wide. The walls for about 10 ft. are good milling ore.

DOME EXTENSION—At a special meeting held in Toronto May 28 the shareholders ratified a bylaw increasing the capitalization from $2,000,000 to $3,000,000 in order to enable resumption of development work.

VIPOND—An attempt is being made to finance operations by offering to shareholders $125,000 in bonds with a bonus of $25 par value common stock with each $100 bond. If the funds can be secured a cyanide plant will be built.

MEXICO

Jalisco

AMAJAC MINES CO.—Excavation for the 50-ton mill at this Hostotipaquillo mine is in progress and building materials are being delivered. The old mill machinery at Amajac is being moved to the mines. Mine developments and exploration work are giving very satisfactory results.

Sonora

GREENE-CANANEA—In the near future the directors intend to ask the stockholders to approve a reduction in the number of shares authorized and outstanding. At present the authorized capital is 3,000,000 shares, par $20. It is proposed to issue 600,000 shares, par $100 and exchange five old for one new share.

LUCKY TIGER-COMBINATION—In April, 2353 tons of ore were treated in the old mill, 3214 tons were treated in the stamp mill, while in the cyanide plant 5355 tons of current and 1869 tons of dump tailings were treated. The estimated value of the products was $156,821, a profit of $80,778 having been made.

THE MARKET REPORT

METAL MARKETS

NEW YORK—June 4

The metal markets have been rather quiet, with some inclination to weakness. The speculation in tin in London is not checked, and the market for that metal is variable.

Copper, Tin, Lead and Zinc

Copper—The continued unsettlement of the financial market has affected sentiment to such an extent that small holders of copper have been forcing their metal on the market regardless of price, and it is reasonable to assume that if there had been more disposition to buy on part of either speculators or consumers, concessions in prices would have been even greater than those which were made up to now. However, the trade at large is thoroughly scared off both here and in Europe and buying is entirely confined to a hand-to-mouth basis. While current consumption leaves nothing to be desired, there is a well defined apprehension that the decline in the prices of securities is foreshadowing a general trade reaction. The close is weak at 15⅝@15⅝c. for Lake copper, and 15@15.10c. for electrolytic copper in cakes, wirebars and ingots. Casting copper is quoted at 14.90@15c. as an average for the week.

The standard market has been under pressure throughout the week, and quotations are still considerably below the parity of refined sorts. The market closes practically at the lowest, the quotations being cabled at £66 15s. for spot, and £66 12s. 6d. for three months.

Base price of copper sheets is now 21@22c. per lb. Full extras are charged and higher prices for small quantities. Copper wire is 16¼@16¾c. per lb., carload lots at mill.

Copper exports from New York for the week were 4732 long tons. Our special correspondent gives the exports from Baltimore at 1797 tons for the week.

Visible stocks of copper in Europe on May 31, are reported as follows: Great Britain, 20,520; France, 3380; Rotterdam, 4800; Hamburg, 3820; Bremen, 1960; total, 34,480 long tons, or 77,235,200 lb. This is a decrease of 3180 tons from the May 15 report. In addition to the stocks given 1700 tons are reported afloat from Chile and 4000 from Australia, making a total of 40,180 tons.

Tin—In anticipation of poor statistics, there developed considerable liquidation in the London market and quotations declined easily. When the figures were published on June 2, they turned out to be even worse than was generally expected, and the disappointment created thereby found its expression in further serious declines. Local buyers took advantage of the drop in prices to replenish their rather low supplies and were free buyers. The market closes weak at £210 5s. for spot, and £209 5s. for three months, and about 46c. here for June tin.

The Banka sale at Amsterdam, May 28, realized an average of 135.65 fl., equal to about 49.45c. per lb., c.i.f. New York.

Visible stocks of tin on May 31, are reported as follows: Great Britain, 6829; Holland, 2277; United States, excluding Pacific ports, 4605; total, 13,711 long tons, an increase of 3889 tons over the Apr. 30 report.

Tin shipments from the Straits in May, are cabled at 6161 long tons; an increase of 401 tons over May of last year.

Lead—The few orders which are coming into the market are eagerly competed for and quotations are easy at 4.17½@4.20c. St. Louis and 4.30@4.35c. New York.

The London market has eased off somewhat, and closes steady at £19 12s. 6d. for Spanish lead, and 7s. 6d. higher for English.

Spelter—There has been more activity during the week, but when sellers who have recently been out of the market saw that they had an opportunity of placing spelter, they supplied the demand quite freely, and in consequence prices have eased off still further. The close is weak at 5.05@5.10c. St. Louis, and 5.20@5.25c. New York.

The London quotation is also somewhat lower, the close being cabled at £22 17s. 6d. for good ordinaries, and £23 5s. for specials.

Base price of zinc sheets is now $7.50 per 100 lb., f.o.b. La Salle, Peru, Ill., less 8% discount.

Bismuth—The syndicate which controls the European production quotes 7s. 6d.—equal to $1.80—per lb. in London. In New York a quotation of $1.72 per lb. is made for metal produced from American ores.

Spanish Exports of Metals and minerals two months ended Feb. 28, reported by "Revista Minera," in metric tons:

	Metals		Ores	
	1912	1913	1912	1913
Pig and mfd. iron	9,241	1,570	1,411,792	1,624,299
Copper	2,017	2,605	27,719	29,245
Copper precipitate	2,194	677	.....	.....
Lead	24,917	31,129	614	244
Zinc	545	19	24,545	20,791
Quicksilver	414	417	.....	.....
Manganese	....	....	5,837	5,296
Pyrites	....	....	407,784	519,375

Pyritic ores carrying 2.5% or over in copper are classed as copper ore; below that point they are classed as pyrites. Exports of salt were 76,003 tons in 1912, and 77,430 tons this year.

DAILY PRICES OF METALS

NEW YORK

May-June	Sterling Exchange	Silver	Copper		Tin	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
29	4.8645	60	15½ @15¾	15.30 @15.40	47⅛	4.30 @4.35	4.17½ @4.20	5.30 @5.35	5.15 @5.20
30	.....	...	.....	.....	...	.....	.....	.....	.....
31	4.8640	59⅞	15½ @15⅝	15.25 @15.35	47⅛	4.30 @4.35	4.17½ @4.20	5.30 @5 35	5.15 @5.20
2	4.8650	60	15⅝ @15⅝	15.10 @15.20	46¾	4.30 @4.35	4.17½ @4.20	5 20 @5.30	5.05 @5.15
3	4.8660	59⅞	15⅝ @15⅝	15.00 @15.10	46½	4.30 @4.35	4.17½ @4.20	5.20 @5.25	5.05 @5.10
4	4.8655	60⅛	15⅝ @15⅝	15.00 @15.10	46	4.30 @4.35	4.17½ @4.20	5.20 @5.25	5.05 @5.10

The quotations herein given are our appraisal of the market for copper, lead spelter and tin based on wholesale contracts with consumers without distinction as to deliveries; and represent, to the best of our judgement, the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. below that of electrolytic. We quote casting copper at 0.15c. below the price for electrolytic. The quotations for lead represent wholesale transactions in open market for good ordinary brands, both desilverized and non-desilverized; the specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium. Silver quotations are in cents per troy ounce of fine silver.

LONDON

May June	Silver	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
		Spot	3 Mos	Best Sel'td	Spot	3 Mos		
29	27 11/16	68¼	68 1/16	74½	215¾	212½	19¼	23
30	27⅜	67 13/16	67⅞	74½	216	213	19⅜	22¾
31	27⅜	....	....	....	....	....	....	....
2	27 11/16	66¾	66¾	72¾	212½	209½	19½	22⅞
3	27⅜	67⅛	67	73	212	209¾	19⅜	22⅞
4	27 11/16	66¾	66⅞	73	210¼	209½	19⅜	22⅞

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c. = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 0.21¾c.

Other Metals

Aluminum—Business has quieted down again and sales have not been heavy. Prices are about the same as last week. No. 1 ingots are 25½@26c. for spot, and 26@27c. per lb. for future delivery.

Antimony—The market is dull with only a retail business doing. Cookson's is quoted at 8.70@9c. per lb.; Hallett's, 8.20@8.50c.; while 7.50@7.80c. is paid for Chinese, Hungarian and other outside brands.

Quicksilver—Business is steady, but not specially active. New York quotations are rather nominal at $40 per flask of 75 lb., with 60c. per lb. for small lots. San Francisco, $39.50 per flask for domestic orders and $37 for export. London price is £7 10s. per flask, with £7 2s. 6d. named from second hands.

Cadmium—The latest quotation from Germany is 725@750 marks per 100 kg. f.o.b. works in Silesia. This is equal to 78.27@80.97c. per lb. at works.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Gold, Silver and Platinum

Gold—The price of gold on the open market in London was unchanged at the Bank level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. There was some pressure for gold for Germany. No further gold has been taken for export in New York.

Iridium—The conditions are unchanged, and the metal still commands about $85 per oz., New York.

Platinum—Business is not especially active, but prices are again unchanged. Dealers ask $45@46 per oz. for refined platinum and $49@52 per oz. for hard metal. The foreign market is reported firmer.

Our Russian correspondent writes under date of May 23 that the market is strong, with a heavy demand, especially from abroad. The starateli are now at work all through the Ural region, but their offerings of metal have decreased. Their working areas have been diminished, as a number of landowners have refused to give leases or working permits, intending to work the lands themselves. Current quotations for crude metal, 83% platinum at Ekaterinburg are 9.75 rubles per zolotnik; at St. Petersburg 37,800 rubles per pood. These prices are equivalent to $36.66 and $37.04 per oz. respectively. These prices are nominal and subject to negotiation.

Silver—The market continues quiet to steady. India is about on a parity with London quotations and no movement of magnitude is apparent.

Exports of silver from London to the East, Jan. 1 to May 22, reported by Messrs. Pixley & Abell:

	1912	1913	Changes
India	£2,626,300	£2,884,000	I. £257,70
China	630,000	299,500	D. 330,500
Total	£3,256,300	£3,183,500	D. £ 72,800

Exports of silver from New York, week ended May 31, were $883,125 to Paris and London. Imports were $132,342, from Central and South America.

Reported stocks of silver at Bombay and Shanghai decreased £245,000 during the week.

Imports of gold into France, three months ended Mar. 30, were 157,889,000 fr.; exports, 18,147,000 fr.; excess of imports, 139,742,000 fr., an increase of 50,375,000 fr. over last year.

Imports of gold into Great Britain, four months ended Apr. 30, were £17,257,730; exports, £12,049,510; excess of imports, £5,208,220, an increase of £2,763,793 over last year.

Zinc and Lead Ore Markets

JOPLIN, MO.—May 31

The high price of zinc blende is $47.50, the base per ton of 60% zinc ranging from $42 to $45, for ore under 4% iron, with no premium offering for ore heavier in iron. Calamine sold on a base of $21@23 per ton of 40% zinc. The average of all grades of zinc is $42.06 per ton. Lead is unchanged at $52.50 per ton of 80% metal contents, and the average of all grades is $52.18 per ton.

SHIPMENTS WEEK ENDED MAY 31

	Blende	Calamine	Lead ore	Value
Totals this week..	11,007,980	624,710	1,894,570	$294,103
Five months	241,142,240	15,925,890	40,457,680	$6,816,683

Blende value, the week, $237,585; 5 months, $5,540,348.
Calamine value, the week, $7070; 5 months, $211,893.
Lead value, the week, $49,448; 5 months, $1,064,442.

PLATTEVILLE, WIS.—May 31

The base price paid this week for 60% zinc ore was $43@44 per ton. The base price paid for 80% lead ore was $52@53 per ton.

SHIPMENTS WEEK ENDED MAY 31

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week	2,783,370	144,000	1,524,030
Year to date	59,443,030	3,089,430	27,195,760

Shipped during week to separating plants, 1,850,290 lb. zinc ore.

IRON TRADE REVIEW

NEW YORK—June 4

Activity continues unchecked at the mills, and production of finished steel is steady. There is a slight improvement in new business, but no marked increase in orders.

Special items in new business are some heavy orders for large pipe for oil lines. Railroad-equipment orders have also been more liberal than for some months past. Structural orders are looking up a little. There is plenty of business in this line, but the difficulty is in financing building projects.

The pig-iron market is uncertain. The demand for iron is larger, perhaps, but at low prices. It looks, however, as if the bottom had been nearly reached, and any marked change must be for the better. A good deal of business has been done in small orders.

There has been an increase in hopefulness among the steel mills in the past week, clearly due to the continuance of heavy pressure upon them for deliveries. The mills are shipping steel at substantially as heavy a rate as at any time. If there has been any decrease, it is too small to be perceptible. Unless jobbers and manufacturing consumers are accumulating stocks, which surely they would be unlikely to do in face of the generally unfavorable sentiment, the indication is that steel consumption is at a new record rate.

Specifications for steel products continue at a rate substantially below the rate of shipping, and there has probably been a slight further decrease during the past week. Of strictly new buying there is scarcely any. In brief, the situation is that the business on books is perfectly sound, there being no cancellations or postponements, but it is being rapidly depleted and little is coming in to take its place.

Pig-Iron Production in Germany, four months ended Apr. 30, is reported by the German Iron & Steel Union as below, in metric tons:

	1912	1913	Changes
Foundry iron	1,046,992	1,190,343	I. 143,351
Forge iron	182,072	176,069	D. 6,003
Steel pig	670,525	847,984	I. 177,459
Bessemer pig	122,257	115,911	D. 6,346
Thomas (basic) pig	3,598,328	3,987,408	I. 389,080
Total	5,620,174	6,317,715	I. 697,541

The total increase was 14.2%. Steel pig includes spiegeleisen, ferromanganese and all similar alloys.

PITTSBURGH—JUNE 3

Following the advance of $1 a ton in merchant-steel pipe and line pipe reported a week ago, the National Tube Co. under date of May 29 advanced some sizes of steel boiler tubes one point, or about $2 a ton, and under date of June 2 oil country goods an average of about $2 a ton. Including in the reckoning the advances of Apr. 12, about $1 a ton in merchant-steel pipe and an average of about $1 a ton in line pipe, there has been a general advance of approximately $2 a ton in all steel tubular goods. The average level of finished-steel prices is now substantially as high as seven months ago, although meanwhile there has been an average decline of fully $2.25 in pig iron.

The recent advances in steel tubular goods are stated to be based upon the fact that the tonnage of business is large, and prices were relatively low, so that even with the advances they are substantially as low as at the low point in 1909.

Pig Iron—There have been several sales of small lots of bessemer pig iron, aggregating less than 1000 tons, at $16.50, Valley, which represents the outside of the market and replaces the nominal quotation of $17, which has been named lately in the absence of sales to indicate where the market really stood. The pig-iron market continues stagnant, and no further declines have developed, though some furnaces expect lower prices before definite buying begins. Quotations are unchanged except for the change in bessemer already

noted: Bessemer, $16.50; No. 2 foundry, malleable and basic, $14.50; forge, $14, f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh. The pig iron averages for May, as compiled by W. P. Snyder & Co. from the actual sales of 1000 tons and over, are announced at $14.899, Valley, for basic, and at $16.78, Valley, for bessemer.

Ferromanganese—The market continues dull, with shading of the contract price on small prompt lots, and we continue to quote prompt at $60@60.50, and forward at $61, Baltimore, with $2.16 freight to Pitsburgh.

Steel—Unfinished steel continues decidedly scarce, and, while buyers of billets and sheet bars expect to contract for third quarter at lower prices than now quoted, the mills are showing decided firmness, and there is a practical deadlock. Demand for prompt steel that is at all special brings out decidedly high prices; for instance, it has been difficult to place orders for large billets of special analysis, though hardly of special quality, at $28, maker's mill. For forward delivery we continue to quote billets at $26.50 and sheet bars at $27, f.o.b. maker's mill, Pittsburgh. Rods are still quoted at $30, Pittsburgh, though the figure would probably be shaded on an attractive inquiry.

Sheets—The sheet market has shown visible improvement in the past week. There is less cutting and more forward buying. Mills are operating at substantially full capacity. We quote blue annealed, 10 gage, at 1.75c.; black, 28 gage, 2.35c.; galvanized corrugated, 3.50@3.55c. per pound.

IRON ORE

Full figures for May shipments of Lake Superior ore have not yet been received, but it is understood that the movement was lighter than had been expected. This was due to the heavy ice on Lake Superior in the first part of the month, and to heavy rains delaying shipments from the mines.

Iron-Ore Production in France in 1912, was 18,800,000 metric tons, an increase of 2,392,000 tons over 1911. Imports were 1,454,000 tons and exports 8,318,000 tons, making consumption 11,936,000 tons. Exports were chiefly to Belgium and Germany. Of the production in 1912, the Nancy basin furnished 1,968,000, the Longwy basin 2,516,000 and the Briey basin 12,676,000 tons.

COKE

The Connellsville production has again declined a little. Producers are firm in their views, and are inclined to reduce output rather than make any concession in prices. Something approaching the deadlock of a few months ago appears likely.

CHEMICALS

NEW YORK—June 4

The general market is still rather quiet, with good deliveries on contract, but not much new business forward.

Arsenic—Demand continues light. Prices are weak at last figures, $3.37½@3.50 per 100 lb. for ordinary brands.

Copper Sulphate—A fair business is doing at unchanged prices, $5.25 per 100 lb. for carload lots and $5.50 per 100 lb. for smaller parcels.

Nitrate of Soda—The dull season is on and the market is quiet. Quotations are unchanged at 2.60c. per lb. for spot, 2.55c. for June, 2.50c. for July and August, and 2.47½c. for later deliveries.

Imports and Exports of Chemicals and raw materials in the United States, three months ended Mar. 31, were as follows:

	Imports		Exports	
	1912	1913	1912	1913
Arsenic, lb.	1,154,778	2,445,371	.....	.....
Copper sulphate, lb.	.....	.....	3,518,671	2,728,918
Bleach, lb.	22,442,639	18,301,971	.....	1,180
Potash salts, lb.	178,739,570	179,608,595	265,208	2,451,521
Soda salts, lb.	3,137,687	3,773,636	130,898	89,427
Acetate of lime, lb.	.....	.....	15,378,365	20,309,977
Nitrate of soda, tons.	105,555	149,394	2,164	1,246
Sulphate of ammonia, lb.	39,343,933	44,520,006	.....	.....
Phosphates, tons.	.....	.....	231,112	229,048
Sulphur, tons.	4,916	2,570	3,267	13,602
Pyrites, tons.	195,286	263,685	.....	.....
Magnesite, lb.	39,839,867	95,616,068	533,150	1,006,710
Chrome ore, tons.	16,849	18,379	.....	.....

Exports include reëxports of foreign material. Some phosphate rock is imported, but is not given separately in the trade returns.

PETROLEUM

Production of petroleum in California in April was 7,943,851 bbl.; deliveries were 8,104,770 bbl., being 160,919 bbl. in excess of production.

Exports of mineral oils from the United States in April were 168,139,013 gal. For the four months ended Apr. 30, the total exports were 529,133,602 gal. in 1912, and 579,958,445 in 1913; an increase of 50,824,843 gal., or 9.6% this year.

The monthly report of the "Oil City Derrick" shows new wells completed in May as follows: Pennsylvania grade, 685; Lima-Indiana, 97; Kentucky, 17; Illinois, 159; Kansas-Oklahoma, 955; Texas-Louisiana, 165. A grand total of 2078 wells were completed, a larger number than ever before. The increase over the April report is 275. All the divisions showed an increase with the exception of Kentucky and Texas-Louisiana. New production is reported at 77,230 barrels. There were four fewer dry holes in all fields, and 17 more gas wells. At the close of May there were 744 rigs up and 2147 wells drilling, a total of 2891; the largest number ever reported.

COPPER SMELTERS' REPORTS

This table is compiled from reports received from the respective companies, except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept. of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield ther is reckoned at 97%. In computing the total American supply duplications are excluded.

	Jan.	Feb.	March	April	May
Alaska shipments	1,668,328	660,250	472,293	1,730,252	.....
Anaconda	21,000,000	21,250,000	22,900,000	23,800,000	25,600,000
Arizona, Ltd.	3,100,000	3,000,000	3,200,000	3,100,000	.....
Copper Queen	7,554,966	6,810,706	7,558,709	8,210,166	8,301,605
Calumet & Ariz.	4,750,000	4,050,000	4,250,000	4,500,000	.....
Chino	3,298,030	3,898,998	4,464,723	3,925,409	.....
Detroit	1,769,071	1,689,277	1,640,671	1,856,517	2,001,633
East Butte	1,469,000	1,325,000	1,400,000	1,400,000	.....
Mammoth	1,957,804	1,661,150	1,641,091	1,450,000	1,700,000
Giroux	650,000	*600,000	*625,000	*600,000	.....
Mason Valley	1,655,319	1,348,070	1,608,492	1,264,304	.....
Miami	.....	.....	.....	.....	.....
Nevada Con.	4,169,705	4,798,537	5,555,320	5,650,608	.....
Ohio	492,760	380,849	596,651	.....	.....
Old Dominion	2,727,000	2,381,000	2,853,000	3,040,000	.....
Ray	3,610,000	3,610,000	4,287,400	4,379,128	.....
Shannon	1,232,000	1,152,000	1,260,000	1,238,000	.....
Tennessee	1,824,637	1,600,151	1,796,394	1,718,188	.....
United Verde*	2,900,000	2,750,000	3,000,000	3,000,000	.....
Utah Copper Co.	7,333,495	7,585,303	8,248,880	9,539,847	.....
Lake Superior*	17,500,000	19,000,000	19,000,000	.....	.....
Non-rep. mines*	5,675,363	5,399,849	6,203,606	.....	.....
Total prod.	96,337,478	94,950,141	102,562,230	.....	.....
Imports, bars, etc.	34,026,236	21,372,292	24,215,480	.....	.....
Total blister	130,363,714	116,318,433	126,777,710	.....	.....
Imp. ore & matte	7,563,758	9,459,432	11,911,041	.....	.....
Total Amer.	137,927,472	125,781,865	138,688,751	.....	.....
Miami†	2,932,369	2,817,200	3,102,200	2,312,900	.....
Shattuck-Arizona	1,381,422	1,136,480	1,234,450	1,158,326	.....
Brit. Col. Cos.:					
British Col. Cop.	720,260	688,312	844,735	794,000	.....
Granby	1,792,245	1,740,000	1,967,962	1,857,452	.....
Mexican Cos.:					
Boleo†	2,658,880	2,535,680	2,204,720	2,811,200	.....
Cananea	5,450,000	4,880,000	4,772,000	3,581,690	.....
Moctezuma	2,913,294	2,730,914	3,062,159	2,753,240	2,695,881
Other Foreign:					
Braden, Chile	1,484,000	1,178,000	1,472,000	1,512,000	.....
Cape Cop., S. Af.	770,540	712,320	732,480	586,880	.....
Kyshtim, Russia	1,644,160	1,352,960	.....	.....	.....
Spassk'y, Russia	974,400	1,003,520	974,400	974,400	.....
Exports from					
Chile	6,752,000	5,824,000	7,840,000	7,616,000	.....
Australia	9,744,000	5,512,000	6,944,000	6,608,000	.....
Arrivals—Europe	17,689,280	8,509,760	15,585,920	10,545,920	.....

† Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister. From May 1, Miami copper is refined in the U. S. and appears under American mines.

Does not include the arrivals from the United States, Australia or Chile.

STATISTICS OF COPPER

	United States			Visible Stocks.		
Month	U.S.Refin'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
V. '12	126,737,836	72,702,277	69,485,945	695,066,02	134,176,000	199,242,029
VI.	122,315,240	66,146,229	61,449,650	49,615,643	117,801,600	167,417,244
VII.	137,161,129	71,094,381	60,121,331	44,335,004	108,186,000	152,521,003
VIII.	145,628,521	78,722,418	70,485,150	50,280,421	113,299,200	163,579,621
IX.	140,089,819	63,460,810	60,264,796	46,701,374	113,568,000	160,269,374
X.	145,405,453	84,104,734	47,621,342	63,065,587	107,408,000	170,473,587
XI.	134,695,400	69,369,795	55,906,550	76,744,964	103,801,600	180,546,564
XII.	143,354,042	58,491,723	65,713,796	86,164,059	96,947,200	183,111,259
Year, 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
I, 1913.	143,479,625	65,210,030	60,383,845	105,312,582	78,491,840	183,904,422
II.	130,948,881	59,676,492	72,168,523	123,198,332	77,504,000	200,702,332
III.	136,251,849	76,585,471	77,699,306	122,302,890	81,244,800	203,547,690
IV.	135,353,402	78,158,837	85,894,727	104,269,270	87,180,800	191,450,070
V.	.....	.....	.....	75,549,108	85,948,800	161,497,908
VI.	.....	.....	.....	.....	77,235,200	.....

Note—From Jan. 1, 1913, visible supplies in Europe do not include copper afloat.

Assessments

Company	Delinq	Sale	Amt.
Algomah, Mich.	June 16	.....	$1.00
Best & Belcher, Nev.	May 20	June 10	0.05
Blue Star, Ida.	May 10	June 17	0.04
Booth Reorg'd, Nev.	May 13	June 9	0.01
Imperial, Ida.	June 2	.....	0.002½
Lucky Calumet, Ida.	May 30	June 21	0.005
Melcher, Utah	May 29	June 19	0.02
Middle Swansea, Utah	June 12	July 3	0.001
Morning Star, Ida	May 24	June 16	0.001
Nabob, Ida.	May 19	June 16	0.005
New Yerington, Nev.	June 10	June 28	0.01
Overman, Nev.	May 28	June 18	0.05
Raven, Mont.	.....	June 25	0.15
Relonia, Utah	May 24	June 24	0.0005
Royal, Ida.	May 31	June 23	0.001
Sandstorm Kendall, Nev.	May 12	June 16	0.01
Shasta Copper Exp., Calif.	May 28	June 16	0.025
Sierra Nevada, Nev.	June 24	July 15	0.10
Silver Pick, Nev.	.....	.....	0.01
Snowstorm Extension, Ida.	May 17	June 14	0.003
Tintic Standard, Utah	June 21	July 19	0.005
Trade Dollar Ext., Utah	May 29	June 17	0.005
Utah Mine, Utah	June 7	June 26	0.05

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1911	1912	1913	1911	1912	1913
January	53.795	56.260	62.938	24.865	25.887	28.983
February	52.222	59.043	61.642	24.081	27.190	28.357
March	52.745	58.375	57.870	24.324	26.875	26.669
April	53.325	59.207	59.490	24.595	27.284	27.416
May	53.308	60.880	60.361	24.583	28.038	27.825
June	53.043	61.290	.....	24.486	28.215	.....
July	52.630	60.654	.....	24.286	27.919	.....
August	52.171	61.606	.....	24.082	28.375	.....
September	52.440	63.078	.....	24.209	29.088	.....
October	53.340	63.471	.....	24.594	29.299	.....
November	55.719	62.792	.....	25.649	29.012	.....
December	54.905	63.365	.....	25.349	29.320	.....
Year	53.304	60.835	.....	24.592	28.042	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1912	1913	1912	1913	1912	1913
January	14.094	16.488	14.337	16.767	62.760	71.741
February	14.084	14.971	14.329	15.253	62.893	65.519
March	14.698	14.713	14.868	14.930	65.884	65.329
April	15.741	15.291	15.930	15.565	70.294	68.111
May	16.031	15.436	16.245	15.738	72.352	68.807
June	17.234	.....	17.443	.....	78.259	.....
July	17.190	.....	17.353	.....	76.636	.....
August	17.498	.....	17.644	.....	78.670	.....
September	17.508	.....	17.698	.....	78.762	.....
October	17.314	.....	17.661	.....	76.389	.....
November	17.326	.....	17.617	.....	76.890	.....
December	17.376	.....	17.600	.....	75.516	.....
Year	16.341	.....	16.560	.....	72.942	.....

New York, cents per pound. London, pounds sterling per long ton of standard copper.

TIN

Month	New York		London	
	1912	1913	1912	1913
January	42.529	50.298	191.519	238.273
February	42.962	48.766	195.036	220.150
March	42.577	46.832	192.619	213.645
April	43.923	49.115	200.513	224.119
May	46.063	49.038	208.830	224.143
June	45.815	.....	205.863	.....
July	44.519	.....	202.446	.....
August	45.857	.....	208.351	.....
September	49.135	.....	223.762	.....
October	50.077	.....	228.353	.....
November	49.891	.....	227.619	.....
December	49.815	.....	226.875	.....
Av. year	46.096	.....	209.322	.....

New York in cents per pound; London in pounds sterling per long ton.

LEAD

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	4.435	4.321	4.327	4.171	15.597	17.114
February	4.026	4.325	3.946	4.175	15.738	16.550
March	4.073	4.327	4.046	4.177	15.997	15.977
April	4.200	4.381	4.118	4.242	16.331	17.597
May	4.194	4.342	4.072	4.226	16.509	18.923
June	4.392	.....	4.321	.....	17.588	.....
July	4.720	.....	4.603	.....	18.544	.....
August	4.569	.....	4.452	.....	19.655	.....
September	5.048	.....	4.924	.....	22.292	.....
October	5.071	.....	4.894	.....	20.630	.....
November	4.615	.....	4.463	.....	18.193	.....
December	4.303	.....	4.152	.....	18.069	.....
Year	4.471	.....	4.360	.....	17.929	.....

New York and St. Louis cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	6.442	6.931	6.292	6.854	26.642	26.114
February	6.499	6.239	6.349	6.089	26.661	25.338
March	6.626	6.078	6.476	5.926	26.048	24.605
April	6.633	5.641	6.483	5.491	25.644	25.313
May	6.679	5.406	6.529	5.256	25.790	24.583
June	6.877	.....	6.727	.....	25.763	.....
July	7.116	.....	6.966	.....	26.174	.....
August	7.028	.....	6.878	.....	26.443	.....
September	7.454	.....	7.313	.....	27.048	.....
October	7.426	.....	7.276	.....	27.543	.....
November	7.371	.....	7.221	.....	26.804	.....
December	7.162	.....	7.081	.....	26.494	.....
Year	6.943	.....	6.799	.....	26.421	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON IN PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1912	1913	1912	1913	1912	1913
January	$15.12	$18.15	$13.32	$17.35	$14.00	$18.59
February	15.03	18.15	13.28	17.22	14.01	18.13
March	14.95	18.15	13.66	16.96	14.10	17.53
April	15.13	17.90	13.90	16.71	14.15	16.40
May	15.14	17.68	13.90	15.80	14.12	15.40
June	15.15	.....	14.11	.....	14.22	.....
July	15.15	.....	14.38	.....	14.38	.....
August	15.43	.....	14.90	.....	14.85	.....
September	16.86	.....	16.03	.....	15.63	.....
October	17.90	.....	17.18	.....	17.22	.....
November	18.07	.....	17.09	.....	18.00	.....
December	18.15	.....	17.45	.....	18.73	.....
Year	$16.01	.....	$14.93	.....	$15.28	.....

STOCK QUOTATIONS

COLO. SPRINGS June 3

Name of Comp.	Bid.
Acacia	.02⅞
Cripple Cr'k Con.	.01¼
C. K. & N.	.12
Doctor Jack Pot.	.07
Elkton Con.	.53½
El Paso	3.35
Findlay	.02⅞
Gold Dollar	.10
Gold Sovereign	.02⅜
Isabella	.10½
Jack Pot	.05½
Jennie Sample	.05½
Lexington	‡.008
Moon Anchor	‡.01
Old Gold	.02½
Mary McKinney	.56
Pharmacist	.01
Portland	.97
Vindicator	.91
Work	‡.004

SALT LAKE June 3

Name of Comp.	Bid.
Beck Tunnel	.05½
Black Jack	.07
Cedar Talisman	.01½
Colorado Mining	.12
Columbus Con.	‡.06
Crown Point	.02½
Daly-Judge	6.40
Grand Central	.50
Iron Blossom	1.32½
Little Bell	‡.35
Lower Mammoth	.03½
Mason Valley	5.00
May Day	.07½
Nevada Hills	.90
New York	‡.00½
Prince Con	.33
Silver King Coal'n	3.50
Sioux Con.	.02
Uncle Sam	.05
Yankee	.05

TORONTO June 3

Name of Comp.	Bid	Name of Comp.	Bid
Bailey	‡.09	Foley O'Brien	.25
Coniagas	‡7.75	Hollinger	‡17.00
T. & Hudson Bay	65.00	Imperial	‡.03
Timiskaming	.33	Jupiter	‡.47
Wettlaufer-Lor	.09½	Pearl Lake	.48
Apex	.01	Porcu. Gold	.06
Crown Chartered	‡.00½	Preston E. D.	.03½
Dobie	‡.15	Rea	.10
Dome	15.00	Swastika	.05½
Dome Exten.	.07½	West Dome	‡.34½

SAN FRANCISCO June 3

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	‡.01	Belmont	6.45
Belcher	.17	Jim Butler	.74
Best & Belcher	.05	MacNamara	.16
Caledonia	‡.84	Midway	.37
Challenge Con	.03	Mont.-Tonopah	‡1.60
Chollar	.02	North Star	.62
Confidence	.27	West End Con.	1.05
Con. Virginia	.11	Atlanta	.16
Crown Point	.20	Booth	.04
Gould & Curry	.02	C.O.D. Con	.05
Hale & Norcross	.06	Comb. Frac	.03
Mexican	.65	Jumbo Extension	.22
Occidental	.70	Pitts.-Silver Peak	.49
Ophir	.13	Silver Pick	.05
Overman	.24	St. Ives	‡.30
Potosi	.02	Tramp Con	‡.02
Savage	.07	Argonaut	‡1.60
Sierra Nevada	.06	Bunker Hill	1.00
Union Con	.10	Central Eureka	.12
Yellow Jacket	.20	So. Eureka	‡2.75

N. Y. EXCH. June 3

Name of Comp.	Clg.
Amalgamated	70½
Am. Agri. Chem	49
Am.Sm.&Ref.,com	62
Am. Sm. & Ref., pf.	100⅞
Am. Sm. Sec., pf. B	82½
Anaconda	35¾
Batopilas Min.	1
BethlehemSteelpf	69⅛
Chino	38⅜
Federal M. & S., pf.	33½
Goldfield Con.	1⅞
GreatNor.,ore,,ctf.	32
Guggen. Exp.	45
Homestake	100¾
Inspiration Con.	16
Miami Copper	22⅛
Nat'nalLead,com.	46
National Lead, pf.	104⅛
Nev. Consol.	16⅛
Phelps Dodge	200
Pittsburg Coal, pf.	80¼
Ray Con	18⅜
Republic I&S,com.	20⅜
Republic I & S, pf.	82
SlossSheff'd,com.	29
Sloss Sheffield, pf.	88
Tennessee Copper	33
Utah Copper	48⅛
U. S. Steel, com	57¼
U. S. Steel, pf.	105
Va.Car. Chem., pf.	103

N. Y. CURB June 3

Name of Comp.	Clg.
Barnes King	1.25
Beaver Con	.34
Braden Copper	6⅛
B. C. Copper	2¾
Buffalo Mines	2¼
Caledonia	‡.40
Con. Ariz. Sm.	⅛
Davis-Daly	2¼
Diam'field-Daisy	.03
Ely Con	.05½
Florence	.37
Giroux	1¾
Gold Hill Con.	2¼
Greene Cananea	6¼
Greenwater	.06
Internat. S. & R.	‡113
Kerr Lake	3⅛
Keystone	‡2
La Rose	2¼
McKinley-Dar-Sa.	1¾
Min. Co. of A. new	2⅜
Motherlode Gold	‡.60
Nev. Utah M. & S.	‡.01
Nipissing Mines	8¾
Ohio Copper	¾
Pacific Sm. & M.	⅛
Puebla S. & R.	2
South Live Oak	‡2
South Utah M. & S.	¼
Standard Oil (Old)	‡1030
Stand'd Oil of N.J.	366
Stewart	1⅛
Tonopah	5⅛
Tonopah Ex.	2⅛
Tonopah Merger	.70
Tri-Bullion	⅛
Tularosa	⅛
Union Mines	⅛
United Cop., pfd.	3
Yukon Gold	2⅛

LONDON May 28

Name of Com.	Clg.
Camp Bird	£0 19s 0d
El Oro	0 15 3
Esperanza	1 3 9
Mexico Mines	5 17 6
Oriental Con.	‡1 8 4
Oroville	0 6 3
Santa Gert'dis	1 5 0
Tomboy	1 6 3

BOSTON EXCH. June 3

Name of Comp.	Clg.
Adventure	1⅜
Ahmeek	290
Algomah	.15
Allouez	31
Am. Zinc	21⅛
Ariz. Com., ctfs.	2¾
Bonanza	.38
Boston & Corbin	⅛
Butte & Balak	1¾
Calumet & Ariz	63¼
Calumet & Hecla	440
Centennial	12
Cliff	1½
Copper Range	41
Daly West	2½
East Butte	10¾
Franklin	5
Granby	59½
Hancock	17
Hedley Gold	32
Helvetia	.30
Indiana	.8
Island Cr'k, com.	46¼
Island Cr'k, pfd.	81½
Isle Royale	21½
Keweenaw	1
Lake	10⅛
La Salle	3¾
Mass	3
Michigan	1¼
Mohawk	47
New Arcadian	1½
New Idria Quick	3¾
North Butte	27
North Lake	1¾
Ojibway	1
Old Dominion	45
Osceola	82
Quincy	60¼
Shannon	8⅛
Shattuck-Ariz.	23¾
Superior	24¾
Superior & Bost.	2½
Tamarack	26
Trinity	3
Tuolumne	2⅛
U. S. Smelting	38
U. S. Smelt'g, pf.	46½
Utah Apex	1½
Utah Con	7⅛
Victoria	1
Winona	1⅛
Wolverine	49
Wyandot	¾

BOSTON CURB June 3

Name of Comp.	Last
Alaska Gold M.	10⅞
Bingham Mines	3½
Boston Ely	½
Boswyocolo	‡.01
Butte Central	1
Cactus	.05
Calaveras	3½
Chief Cons	1½
Corbin	.89
Cortez	.30
Crown Reserve	3⅛
Eagle & Blue Bell	.98
First Nat. Cop.	1½
Majestic	.35
Mexican Metals	.69
Moneta Porc.	‡.06
Nevada-Douglas	2
New Baltic	.90
Oneco	.85
Raven Copper	.04
Rhode Island Coal	.02
Smokey Dev.	1½
S. W. Miami	2½
South Lake	4
Trethewey	‡.30
United Verde Ext.	.60

‡Last quotation.